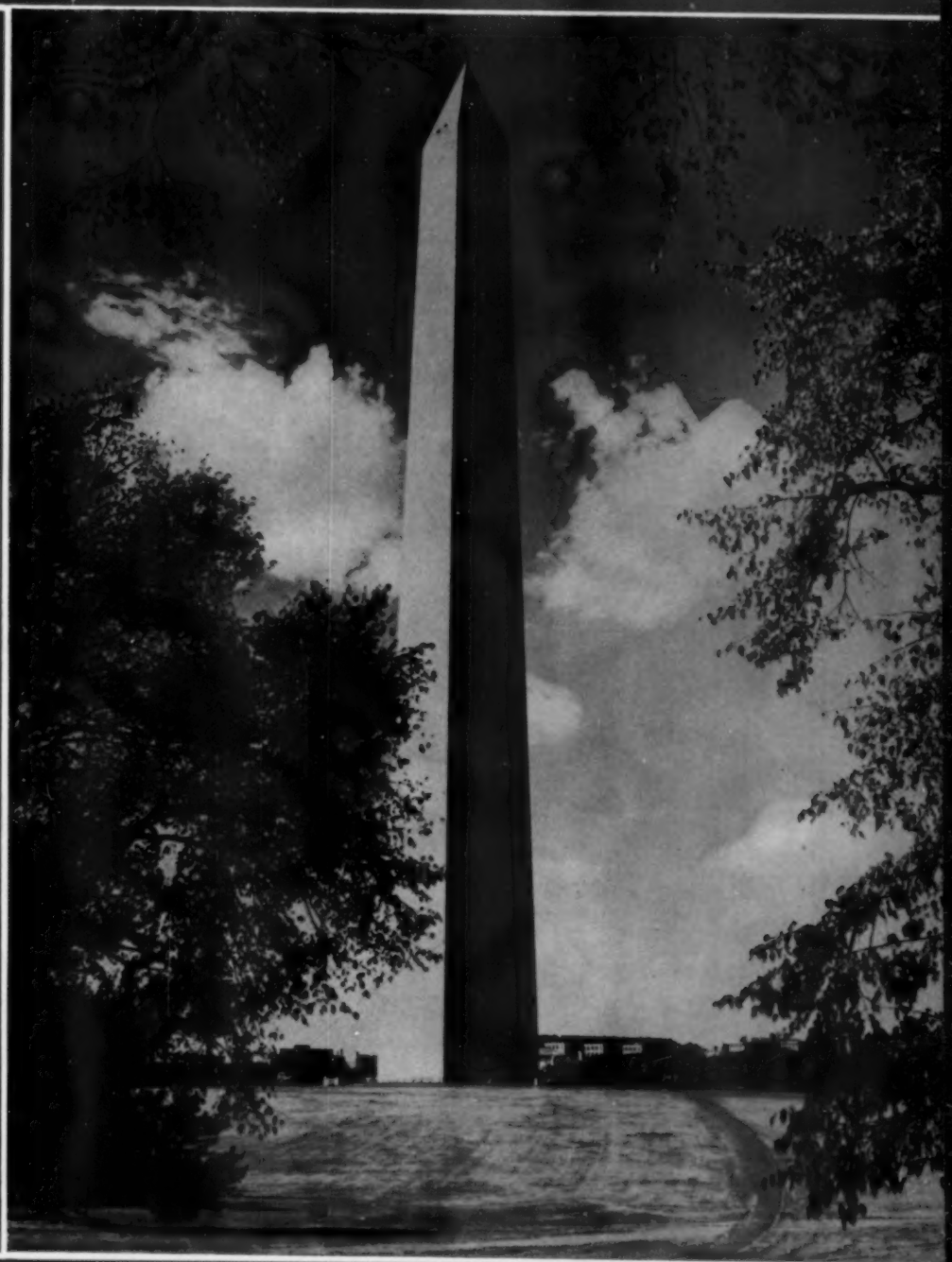
Vol. XXIII, No. 2
MARCH 1956

THE SCIENCE TEACHER

1956 Annual National Convention

Washington, D.C. • March 14-17



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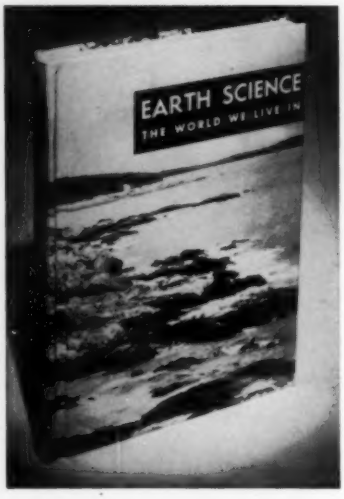

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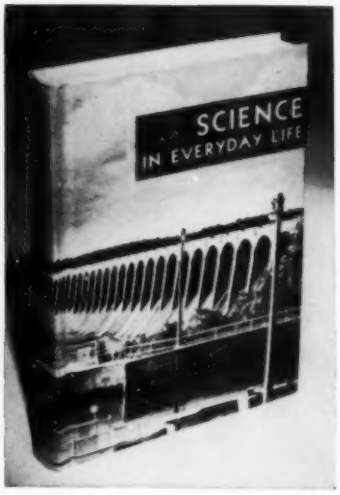

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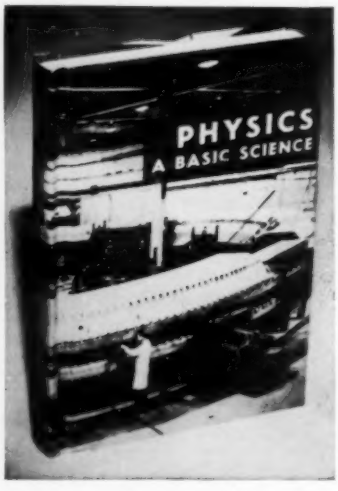

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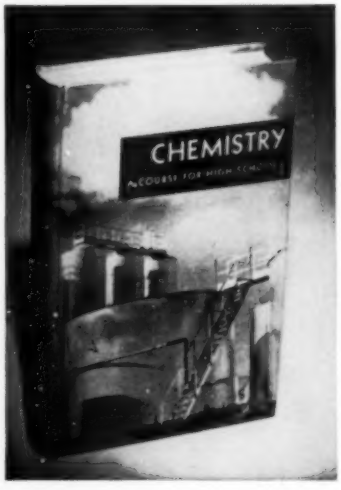

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ST-O

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PROTEIN	65 Gm.	7.85 Gm.	12
CALCIUM	0.8 Gm.	0.17 Gm.	21
IRON	12 mg.	1.44 mg.	12
PHOSPHORUS	1.2 Gm.	0.215 Gm.	18
VITAMIN A	5000 I.U.	187.5 I.U.	4
THIAMINE	1.6 mg.	0.16 mg.	10
RIBOFLAVIN	1.6 mg.	0.24 mg.	15
NIACIN	16 mg.	1.4 mg.	9
CALORIES	3200	208	6.5

OF THE NUTRIENT CONTRIBUTION OF THE CEREAL AND MILK SERVING . . .

As the table above vividly shows, the nutrient contribution of the cereal and milk serving** is unusually generous, not only as to the number of nutrients, but also as to the amount of each nutrient supplied. In the case of most nutrients, 10 per cent or more of the National Research Council's Recommended Daily Dietary Allowances for a physically active male is supplied by this serving. Any food which contributes 10 per cent of the daily requirement of a given nutrient in each 200 calories of that food, is considered a good source of that nutrient. A glance at the chart above shows that the cereal and milk serving comes close to making this ideal contribution. Of added nutritional significance is its generous contribution of B complex vitamins and iron and the high calcium content.

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*National Research Council's Recommended Daily Dietary Allowances—Revised 1953.

**1 oz. of breakfast cereal (whole grain, enriched or restored), 4 oz. whole milk, 1 teaspoonful of sugar. Based on composite average of breakfast cereals on dry weight basis.

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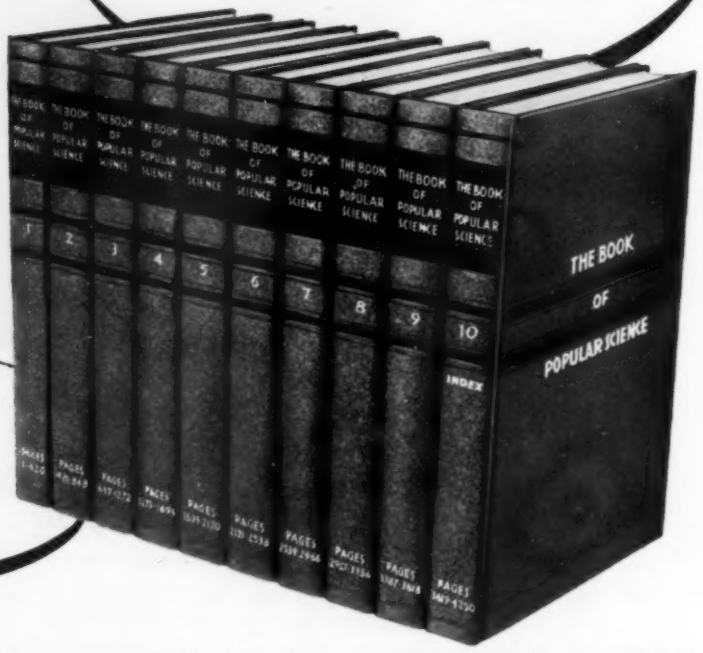

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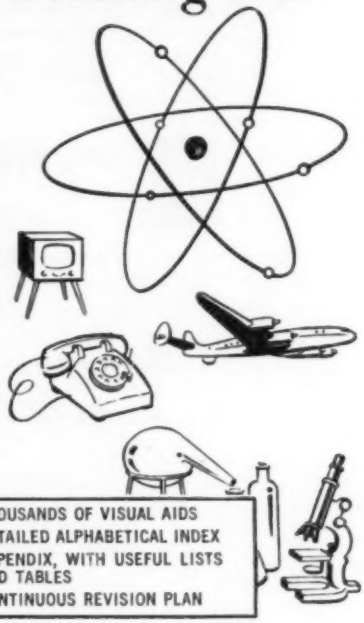

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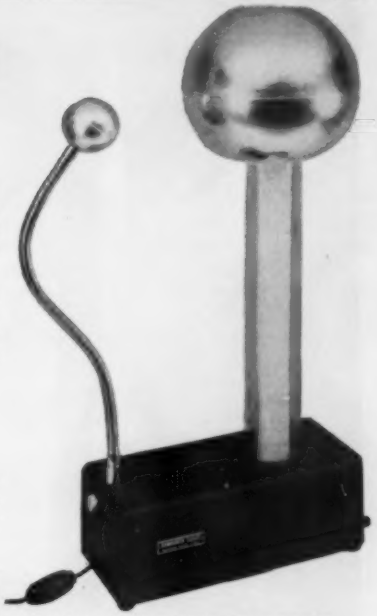

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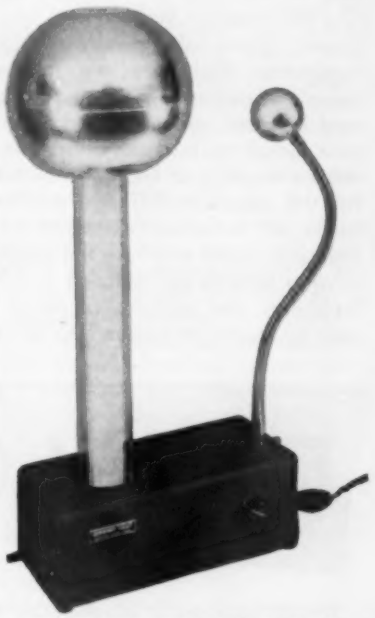

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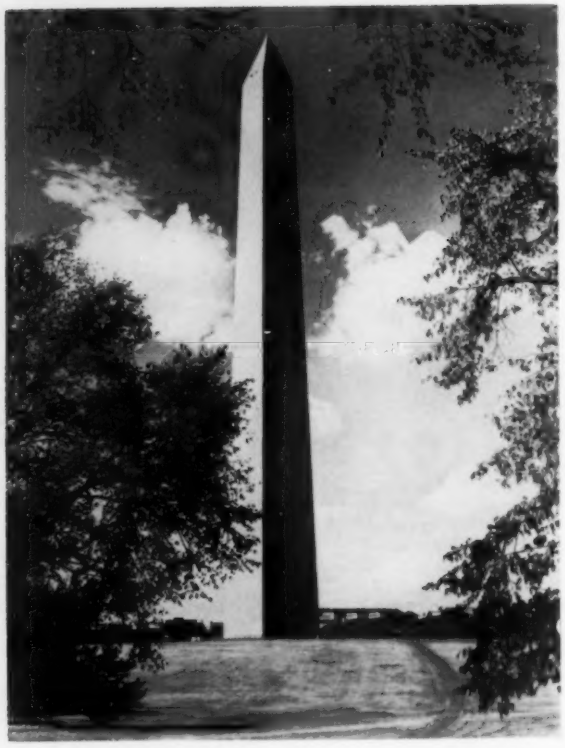

THIS MONTH'S COVER . . . Washington, D. C., site of the Fourth National Convention of NSTA. The Washington Monument is one of the many monuments, memorials, and buildings that will remind registrants that they are in the Nation's capital. Science teachers, scientists, science teacher trainers and trainees, administrators, representatives of business-industries, and exhibitors of science teaching aids will be meeting at The Shoreham Hotel, March 14-17, for this occasion. Six government research laboratories will welcome registrants on Friday and Washington scientists will take the place of science teachers in area schools on Thursday and Friday. Convention highlights and pictures of many of the participants may be found on pages 100-102 of this issue.

Readers' Column

I read with great interest the June, 1955 issue of *Physics Today* sent by NSTA. The general problem and many of the suggested solutions are, I think, fairly clear and familiar to science teachers, and I hope and believe of great interest to them. My reason for responding to your invitation to comment is the desire to bring up what is perhaps a minor point, but one which seems to me to have been rather neglected in deliberations such as that of the recent conference of the American Institute of Physics.

Although I teach a somewhat selected group, I am fairly well acquainted with the general problems faced by secondary school teachers and it strikes me that the greatest single obstacle in the production of the necessary number of science and engineering majors is the feeling, very current among the students, that only the near-genius can feel confident in electing such a career.

Perhaps this is true; and if it is, the future looks black and the rest of my remarks will not be appropriate. If it is not true, it would seem worthwhile to look into the reasons for this idea, the widespread prevalence of which I am convinced. The source of the idea lies very much with "physics," both in high school and college.

If high school students are questioned, a large percentage will answer that physics is the most difficult subject in the curriculum. If college freshmen are questioned, they will give the same answer. As long as a student's rank in his class is so important for his college entrance and a freshman's rank is so important for scholarship purposes or for continuance in certain Service programs, many will shy away from a subject which looms as a threat to their success. I do not know whether there is any statistical evidence for this belief as far as it concerns the high school. I do know that a survey of a number of college engineering schools revealed that only 29 per cent of the freshmen completed their courses in the normal four years.

It is my belief that the students' difficulty with physics, both in high school and college, stems from the fact that the neophyte is required, from the very start, to reach a considerable sophistication in the subject. In continuing subjects, such as mathematics, this sophistication has a chance to develop. The sciences, however, can be considered continuing subjects only insofar as students beginning physics or chemistry have already been exposed to courses labelled "general science," and these courses, stimulating as they are to learn and teach, tend to be far removed from the rigid discipline of high school and college chemistry and physics.

PAUL JULIFF
The Choate School
Wallingford, Connecticut

Congratulations on the February issue of *The Science Teacher*. This is a real milestone in achieving help for the classroom teacher. Please send me two additional copies for our administrators.

ENID A. LARSON
Carmel High School
Carmel, California

EDITOR'S NOTE: *This is one of many comments we have gratefully received.*

THE SCIENCE TEACHER

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in the April issue of *The Science Teacher*

- Nuclear Energy
- Earth Science in the Secondary School
- Science Teacher Recognition Awards—1955 Program
- Making Photographic Prints in the Classroom

Editor's Column

Undoubtedly there is a shortage of qualified science teachers available for service in our schools. In view of this, no promising idea to help alleviate the situation should be lightly cast aside without the most careful consideration. The latest idea is the proposal by Mr. David Sarnoff, Chairman of the Board of Radio Corporation of America; namely, "The establishment of a 'National Educational Reserve' comprising qualified teachers in mathematics, physics, chemistry, engineering and related subjects, to be drawn from the technological ranks of industry. I have in mind the release—and with full pay for at least a year—of a reasonable number of men and women for teaching assignments in their local schools. This unique Reserve could also mobilize those who have reached the retirement age but whose knowledge and experience would make them inspiring teachers. In addition, it could include qualified people willing to volunteer their services to teach in night schools without giving up their industry jobs. . . . This Education Reserve would, of course, have to be strictly an interim program, let's say for five years, to help meet an immediate situation. . . . Men and women who normally would have become teachers of the sciences have instead gone into industry, where the rewards are more enticing. I think it is fair to say, in fact, that in the current crisis industry has an obligation to help develop this kind of Educational Reserve. . . . Because of their practical experience, teachers in the Educational Reserve Corps would bring the breath of living reality into the classroom. They would help restore the sense of adventure to technical careers and inspire many an able and imaginative student to follow the scientific and technolcgical disciplines into the college years."

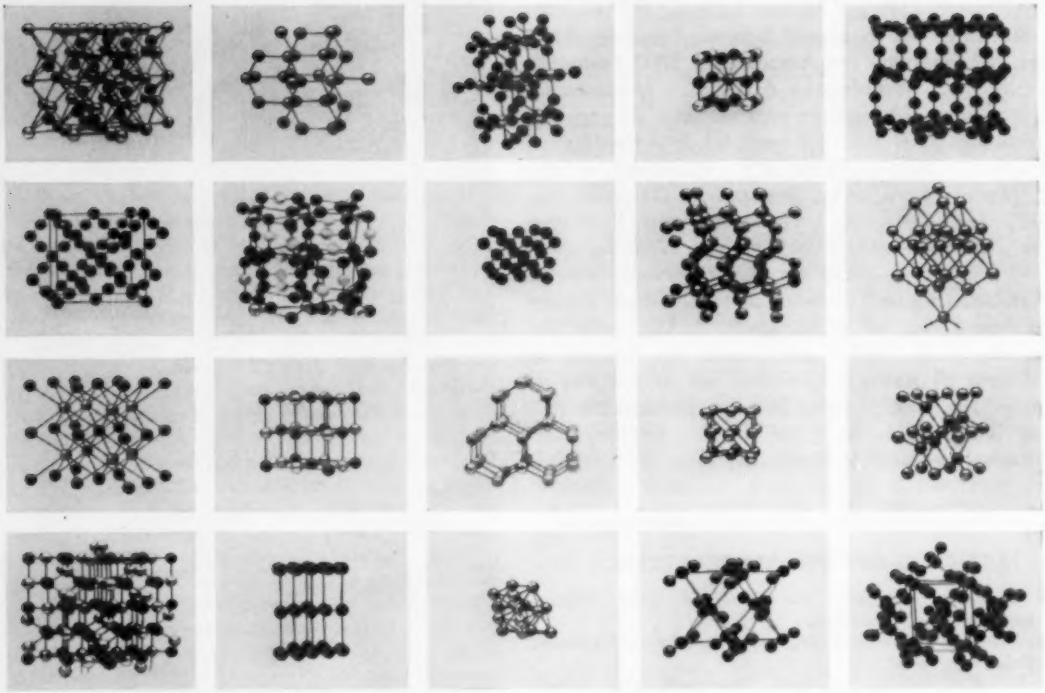
Perhaps Mr. Sarnoff has already consulted with school personnel on the feasibility and acceptability of his plan. If so, I fear he has been ill-advised. It promises nothing to help correct the fundamental cause of our current problem. Nevertheless, NSTA is ready to participate in any objective and serious study of the idea. Here are some of the questions that I think would need to be explored.

How well would the need for science teachers match the availability of scientists? The plan mentions scientists serving in schools in their local communities. Would we be prepared to transport a scientist from, say, the Pittsburgh area to teach for one year in a 113-pupil high school in Nebraska?

If industry's need for scientists is as critical as reported, how can companies afford to release a "qualified" scientist for a year without serious interruption of the research and/or development projects in which he is engaged—perhaps as a member of a "team"?

Who, or what agency, would develop and administer the idea? The U. S. Office of Education? The Department of Defense? A committee from industry? The AAAS? Or, possibly, a council from the education profession itself, comprised of representatives of the NEA departments of science, mathematics, secondary school principals, and school administrators and augmented by representatives from the

(Please continue on page 119.)



Crystal structure models. Top row, left to right: cuprite, zincblende, rutile, perovskite, tridymite. Second row: cristobalite, potassium dihydrogen phosphate, diamond, pyrites, arsenic. Third row: caesium chloride, sodium chloride, wurtzite, copper, niccolite. Fourth row: spinel, graphite, beryllium, carbon dioxide, alpha-quartz.

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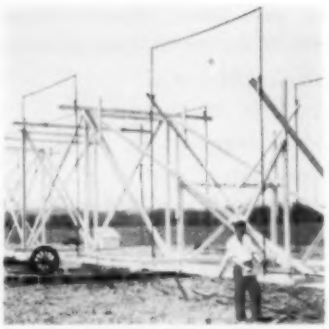
These men have developed the world's finest telephone system. In doing so, many have become leaders in their fields. Opportunities for achievement await qualified scientists and engineers at Bell Telephone Laboratories.



Directional antenna used by Karl G. Jansky in discovery of stellar radio signals at Bell Telephone Laboratories in 1932.

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THE SCIENCE TEACHER

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METALLURGICAL ENGINEERING AS A CAREER

By M. S. BURTON

Associate Professor of Metallurgical Engineering, Cornell University, Ithaca, New York

SECONDARY SCHOOL STUDENTS who have shown aptitude for scientific thought and have obtained good grades in chemistry, physics, and mathematics, usually consider science and engineering when planning a career. Many students, however, overlook metallurgical engineering as a professional field; many are uninformed as to the opportunities in this division of engineering.

Unfortunately, the study of metals has not been publicized or glamorized as have some other fields of engineering, and it may be overlooked.

Shortage of Metallurgical Engineers

Demand for engineering graduates exceeds the supply of trained men in all branches of engineering; the most drastic shortage is of men trained in metallurgical engineering. Excellent jobs remain unfilled.

This shortage of qualified men is not temporary or transitory. In 1953, baccalaureate degrees were awarded to approximately 24,000 persons. Ten thousand of these degrees were in the various branches of engineering, but less than 400 were for successfully completing a course of training in metallurgy or metallurgical engineering. Fifty-three schools offer accredited curricula in metallurgy, yet the average graduating class consists of seven students!

The reason for this low enrollment is the lack of information—or even the abundance of misinformation—as to the character of the curricula and the type of work done by metallurgical engineers. Some students mistakenly classify metallurgy as a very theoretical science. Others consider it a dirty and undesirable branch of engineering. They are uninformed as to the breadth and scope of the profession.

What Is Metallurgical Engineering?

The usual dictionary definition of metallurgy is "the science and art of extracting metals from their ores, refining them, and preparing them for use." This definition indicates that metallurgy encompasses science, art, and technology. It is both a physical science and a branch of engineering.

In contrast to the definite distinction that may be drawn between a chemist and a chemical engineer, no distinction is possible between a metallurgist and a metallurgical engineer. The words are essentially synonymous. All metallurgical curricula

Metallurgical engineering students welding various metals to learn correct procedures.

PHOTO SCIENCE STUDIOS, CORNELL UNIVERSITY

PHOTO SCIENCE STUDIOS, CORNELL UNIVERSITY

Metallurgical engineering students pouring test heat of steel from electric furnace. Observer at left is measuring temperature using optical pyrometer.

include the fundamentals of metal science as well as the principles of metallurgical engineering, regardless of the name or type of degree awarded.

As a science, metallurgy includes study of the nature of metals, the characteristics of plastic deformation, heat treatment, the nature of alloying, and many other similar phases. As engineering, metallurgy involves the manufacturing and refining of metals and alloys, the techniques of metal fabrication and heat treatment, etc. Modern metallurgy involves close integration of science and engineering and requires a broad and fundamental background in the basic and applied physical sciences.

In an attempt to define the breadth and scope of metallurgical engineering training, the following outline is given. The presentation is not in terms of individual courses of a particular curriculum, but rather as the types of courses generally found in all metallurgical curricula.

OUTLINE OF METALLURGICAL ENGINEERING

I. Metal Science
   - A. Chemical Metallurgy
     1. Thermodynamics
     2. Reaction kinetics
     3. Thermochemistry
     4. Electrochemistry
     5. Slag-metal-atmosphere reactions
   - B. Physical Metallurgy
     1. Nature of metals and alloys
     2. Physics of metals
     3. Metallography
   - C. Mechanical Metallurgy
     1. Elastic and plastic behavior
     2. Fatigue and creep
     3. Correlation of structure with mechanical properties
     4. Relationship of design and shape to mechanicial properties

II. Metal Engineering
   - A. Process Metallurgy
     1. Extractive metallurgy
     2. Smelting, refining, and alloying
     3. Heat transfer
     4. Fuels and refractories
     5. Electrometallurgy
   - B. Metal Processing
     1. Casting
     2. Hot and cold forming
     3. Welding
     4. Powder metallurgy
     5. Heat treatment
   - C. Application Metallurgy
     1. Selection and specification
     2. Analysis of service behavior

What Do Metallurgical Engineers Do?

There are many more employment opportunities in metallurgy than men available to fill them. Excellent positions for supervisory, operating, re-

SUMMER INSTITUTE FOR TEXAS HIGH SCHOOL PHYSICS TEACHERS, June 4 to July 13, Agricultural and Mechanical College of Texas, College Station. The six-week program of the Institute will be taught by the physics faculty and will offer six semester hours of graduate credit in education for teachers desiring to improve their preparation for the teaching of high school physics. $250 fellowships from Texas industries are available. Direct inquiries regarding the program to: J. G. Potter, Department of Physics.

1956 TESTING PROGRAM OF THE ACS EXAMINATIONS COMMITTEE. Two new tests, Organic Chemistry (Form MB) and General Chemistry (Form M) have been added to the several forms now available in each of the fields of general, organic, qualitative, quantitative, physical, and biochemistry. Further information and copies of all the tests may be obtained from Theodore A. Ashford, St. Louis University, St. Louis 4, Mo.

FOURTH ANNUAL WORKSHOP FOR COLLEGE PROFESSORS, June 25 to July 13, The University of Michigan. Features of the workshop include presentations by a special staff, discussions, and projects to assist individuals develop new ideas and fresh materials for their academic courses. Additional information may be obtained from: Algo D. Henderson, Director, 2442 U.E.S., University of Michigan, Ann Arbor.

search, and sales personnel remain unfilled in many of the industries of the country. Steel mills, plants producing and refining copper or aluminum, industries manufacturing newer engineering metals, such as titanium, are actively seeking trained metallurgists at this time.

Metal founders and fabricators also require the assistance of metallurgists for management, research, development, and sales. Many companies in this category have only recently felt this need, and are now actively recruiting metallurgical engineers. This results in further supply problems in an already tight market.

To assist in the development of trained recruits for their industry, foundrymen have established within the past decade the Foundry Educational Foundation, with offices in Cleveland, Ohio, to foster education in cast metals at the college level. Scholarship aid from this organization is available at a number of colleges and universities for students who indicate an interest in foundry work as a career.

In many instances, metallurgists are engaged in the selection and application of materials for particular service. This entails proper evaluation of service requirements and a thorough understanding of the properties of materials. Most often the selection is not entirely obvious but requires that test programs be developed to study the operating conditions before a suitable engineering solution can be realized. Selection is also controlled very closely by costs and availability. Often the problem of selection is one of choosing alternate materials that are more readily available or are available at less cost to replace a suitable but more costly part.

Metallurgical scientists are needed for research, to develop new materials or alloys, and to satisfy the demands for higher strength materials for tomorrow's products. Metallurgical engineers are needed for sales and technical service, since the complexity of present materials is too great to entrust the application and specification to men not versed in metallurgical knowledge.

Opportunities of the types described exist in the laboratories of metal producers and metal fabricators. However, there is an even greater number of similar opportunities for trained metallurgists with companies that might be overlooked—such as the producers of electrical equipment, aircraft builders, automobile manufacturers, petroleum refineries, and many others.

Opportunities

As in other branches of science and engineering, industry does not want men who merely know the contents of today's textbooks, but are actively seeking men who will be creative and who will be leaders in their rapidly-changing profession. New metals, new alloys, new processes, and new applications are constantly being developed to require continual growth of metallurgical knowledge after graduation.

New products and processes result from ideas conceived in the minds of men, and thus it is important that the metallurgist like people and be able to communicate with his fellows. Metallurgy is not a static world of hardware and machines, but rather a world of implementation of ideas. It requires that the three R's be supplemented by a progressive attitude and constructive action.

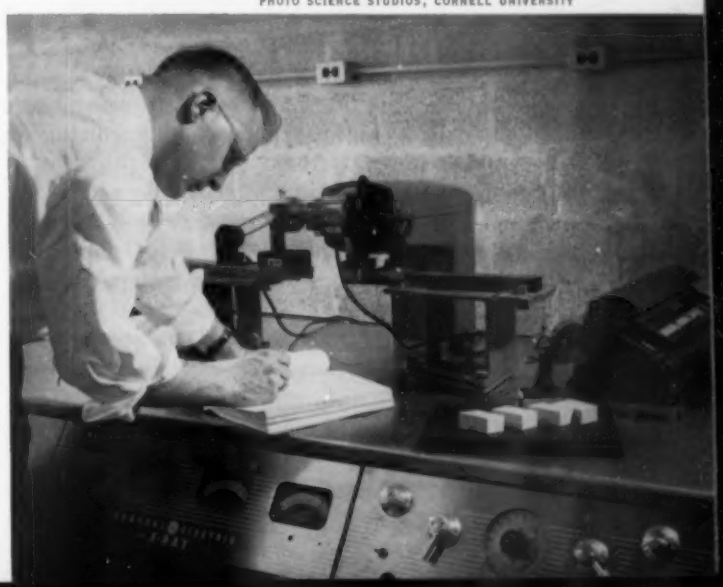
The horizons are unlimited. Young metallurgical engineers are being sought today in increasing numbers, and the present college enrollment indicates that the demand will not be satisfied for many years to come. With interesting and rewarding work, with a tremendous choice of positions, with above-average income, and with rapid professional advancement, metallurgical engineering presents unusual attraction to the secondary school student who is planning a career.

Individuals of high school age, their parents, and their counselors, should acquaint themselves with the advantages of a career in metallurgical engineering.

The writer will be happy to provide more specific information concerning metallurgical engineering curricula, job opportunities currently available, and metallurgical engineering careers. Another source of helpful information is the American Society for Metals, 7301 Euclid Avenue, Cleveland, Ohio.

X-ray diffraction techniques are used to determine the position and spacing of atoms in metals. A senior metallurgical engineering student is recording diffraction angles and intensities in special cameras.

PHOTO SCIENCE STUDIOS, CORNELL UNIVERSITY



TRENDS IN JUNIOR HIGH GENERAL SCIENCE

By KEITH SMITH

Supervisor of Science, Public Schools, Los Angeles, California

A QUESTIONNAIRE on "What Is Happening to General Science in Your School" was sent to NSTA members in Packet XXXII, last spring. More than 100 replies have been received from various schools and school systems in the United States. The cooperation of those who returned the replies is greatly appreciated.

TABLE I

NUMBER OF SCHOOLS REPLYING, BY STATES

Connecticut	4	California	5
Florida	1	Colorado	2
Georgia	1	Iowa	2
Illinois	7	Kansas	1
Indiana	5	Minnesota	5
Kentucky	1	Montana	1
Louisiana	1	Nebraska	2
Maryland	3	North Dakota	1
Massachusetts	3	Oklahoma	1
Michigan	4	Oregon	2
New Jersey	6	Texas	2
New York	20	Wyoming	1
Ohio	9		
Pennsylvania	9		
Tennessee	1		
West Virginia	1		
Wisconsin	3		
East of Mississippi	79	West of Mississippi	25

The questionnaire was devised to study certain trends relating to the time devoted to general science, topical coverage, and pupil enrollment during the ten-year interval, 1945-1955.

The first part of the questionnaire requested a report on time spent in periods per week, time in minutes per period, and percentage of pupils enrolled in general science in 1945 as compared with 1955.

The information requested in the second part relates to the distribution of content taught. Biological science, health science, physical science, and earth sciences are the four categories represented.

Part III endeavored to determine gains or losses in time per week for general science. In other words, if general science gained in time per week, what gave way to make room for it; if general science lost in time per week, what replaced it?

The questions in Part I and Part III designated grade levels so that specific information was reported for grades 7, 8, and 9, respectively.

Table I shows the geographical distribution of the returns by states; 79 replies being received from states east of the Mississippi and 25 from states west of the Mississippi. Reports from New York City, Minneapolis, Rochester, and the Los Angeles school systems are given separately.

Table IIa shows the distribution of time in periods per week, by grade level, devoted to general science in 1945 and 1955.

Table IIb summarizes the data reported in Table IIa. To obtain the total number of periods per week reported for general science teaching at the three grade levels, the product of number of schools reporting multiplied by the number of periods reported was taken and summarized. The per cent of

TABLE IIa

TIME IN PERIODS PER WEEK

	PERIODS PER WEEK 1945									PERIODS PER WEEK 1955									
	10	6	5	4	3	2½	2	1	0	15	7	6	5	4	3	2½	2	1⅔	1	0
7TH GRADE:																				
No. of Schools			25	8	5	2	11	3	50				39	8	8	4	6	1	1	37
8TH GRADE:																				
No. of Schools			37	9	6	2	11	3	36		1		51	9	9	3	5	1	1	24
9TH GRADE:																				
No. of Schools	1	1	68	4	3	0	0	1	26	1	1	1	72	7	1	0	0	0	1	20

TABLE IIb

TOTAL NUMBER OF PERIODS PER WEEK AND PERCENT CHANGE

	1945	1955	
	TOTAL PERIODS PER WEEK REPORTED	TOTAL PERIODS PER WEEK REPORTED	PERCENTAGE GAIN PERIODS PER WEEK
7TH GRADE	202	275	36%
8TH GRADE	269	344	28%
9TH GRADE	382	420	10%

TABLE IIIa

TIME IN MINUTES PER PERIOD

	0	30	40	42	43	45	47	48	49	50	53	54	55	57	60	65	200	275
7TH GRADE:																		
Schools 1945	51	0	8	0	3	22	2	0	1	7	1	1	6	0	2			
Schools 1955	37	1	8	1	2	22	2	0	1	13	1	2	11	0	3			
8TH GRADE:																		
Schools 1945	37	0	9	1	3	22	2	0	1	14	1	1	8	0	5			
Schools 1955	27	1	7	2	2	22	3	0	1	19	1	2	11	0	5	1		
9TH GRADE:																		
Schools 1945	30	0	8	1	3	24	4	0	0	9	2	1	14	1	5	0	1	1
Schools 1955	19	0	8	2	2	24	5	1	1	15	1	2	11	0	10	1	1	1

change was computed for the ten-year interval and is shown in the table.

It thus appears from the reports that each grade has gained significantly in periods per week for general science since 1945.

Table IIIa details the report of time distribution in minutes per period as reported for the three grades during the 1945-1955 interval.

Table IIIb shows the summary of the total number of minutes per period by grade levels as reported in Table IIIa.

TABLE IIIb

	1945 TOTAL PERIOD MINUTES REPORTED	1955 TOTAL PERIOD MINUTES REPORTED	PERCENTAGE GAIN MINUTES PER PERIOD
7TH GRADE	2489	3207	29%
8TH GRADE	3211	3741	16%
9TH GRADE	3971	4558	15%

Again, a significant gain in time is shown in the report on minutes per period for 1945 and 1955 for each of the three grades in the study.

Table IV reports the percentage of students enrolled at each grade level for 1945 and 1955. The table is arranged in 10 per cent step intervals.

Significant percentage gains in student enrollment show up in the (90-100) percentage column for each of the three grades reported. Fourteen schools report gains in the 7th grade, eleven schools in the 8th grade, and five schools in the 9th grade. The remaining percentage columns show no significant change in enrollment during the interval 1945 to 1955.

Table V shows approximate percentages of content covered in general science as reported by schools.

An interpretation of these results is difficult because of the approximations employed in reporting. A study of the table shows that the highest frequency of schools falls in the 20-30 percentage column for each of the four subject areas of content reported.

Reports from City School Systems

Questionnaires representative of four large-city systems were returned from Los Angeles, Minneapolis, New York, and Rochester. Analysis of these returns shows that the general science program has remained quite stable in these cities during the interval covered by the questionnaire. There are some interesting variations which are worthy of note, however.

Minneapolis, New York, and Rochester require two or three periods of general science per week at the 7th and 8th grade levels. In Los Angeles no science is offered at the 7th grade level but is required at the 8th grade level. All four systems require general science at the 9th grade level.

TABLE IV

PERCENTAGE OF STUDENTS ENROLLED

	0	1–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–100
7TH GRADE:											
Schools 1945	50				1				1	1	51
Schools 1955	37				1				1		65
8TH GRADE:											
Schools 1945	36				1				1		66
Schools 1955	24	1			1				1		77
9TH GRADE:											
Schools 1945	31	1	1	6	5	3	4	1	5	3	44
Schools 1955	19	2	3	9	4	5	3	1	5	4	49

TABLE V

APPROXIMATE DISTRIBUTION OF AREAS COVERED IN PER CENT

SCIENCE:	0	1–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–100
Biological: No. of Schools	9	3	26	36	20	3	5	1			
Health: No. of Schools	13	15	34	30	6	2					3
Physical: No. of Schools	7	0	2	25	20	23	14	6	1	3	1
Earth, Meteorology, Astronomy. No. of Schools	10	1	26	36	13	9	3	2	1	2	

J. Hervey Shutts, Consultant in Science, Minneapolis, reports that beginning in the fall of 1955 each child in each year of junior high will be required to have one semester of science 60 minutes each day, five days each week. The new science content is to omit "Health." This will be taught by the physical education, health, and safety division. The new science content will be distributed about equally between biological, physical, and earth sciences. An integrated science curriculum from kindergarten through twelfth year is contemplated as a project to be completed by 1960.

Alfred D. Beck, Science Supervisor, Junior High School Division, New York City, reports at present the 0-4-5 plan is preferred because it has many advantages. However, the goal is for a 4-4-5 plan. The numbers refer to periods per week at the 7th, 8th, and 9th grade levels. Certain Special Progress pupils do 3 years work in 2 years. They have a 2-4 plan. Regarding content, Mr. Beck states that the trend of thinking is to base the course on Problems of Living, not on per cent of time to be accorded to samples of traditional science subject matter. Life-problem situations involve all branches of science subject matter and should not be compartmentalized.

Clarence B. Evaul, Board of Education, Rochester, reports that there has been no loss of time in the 8th grade science, but a rearrangement of the time schedule gives a science class five times a week for one-half year instead of two times a week for the whole year.

In Los Angeles, a year of general science is required at the 8-9 grade level; one semester may be taken in either B8 or A8, and one semester in B9. General science may be taken as an elective in A8 and A9. Classes are held five periods per week with a standard period of 53 minutes. The problem-solving approach is emphasized throughout. Objectives stress providing the pupil with important scientific knowledge and understanding about himself and his environment. General science includes instruction in first aid, fire prevention, safety, and the effects of alcohol and narcotics. These topics are required as part of the instructional program by the State Education Code. During the 9th year greater emphasis is given to instruction about man's physical environment. However, the main objective of science understandings and its uses as related to man and his environment are more important than any specific percentage of subject matter content.

Summary

The replies to the questionnaire represent a widespread geographical distribution of schools including four large-city school systems. The schools and school systems total more than 300 teaching situations in general science.

The replies show that general science has gained in time in periods per week at each grade level. The 7th grade shows the greatest percentage gain and the 9th grade level shows the least. One possible conclusion would be that articulation of science instruction is becoming more continuous from the elementary grades through 7, 8, and 9.

The replies show an appreciable increase in time in minutes per period at each grade level. Again, the 7th grade shows the greatest percentage gain and the 9th grade shows the least.

The gain in enrollment follows a similar pattern; the 7th grade showing the greatest gain and the 9th grade the least.

No significant pattern appears from the replies to the question on approximate distribution of subject area content covered in general science instruction. All content areas appear in the instructional program but emphasis differs from school to school.

General science in the large city systems appears to have been well established as part of the curriculum throughout the ten-year interval covered by the questionnaire. There is a report that plans for an integrated science program from kindergarten through the twelfth year are under way in one large city.

NATIONAL ENROLLMENTS IN HIGH SCHOOL SCIENCE

By KENNETH E. BROWN

Specialist in Mathematics, U. S. Office of Education, Washington, D. C.

THE critical shortage of scientists has caused many persons of national influence to quote statistics on the number of pupils enrolled in high school science. Many times the statements seem to be contradictory. What is the cause of these apparent discrepancies? There may be two causes. The data may be out of date or they may be misinterpreted.

A casual glance at the table below might lead one to think that the number of high school pupils taking chemistry has decreased over the years. This is far from the facts. Since 1900, the enrollments in chemistry have increased twelvefold; the percentages have declined.

The percent of pupils in the last 4 years of public secondary day schools who are enrolled in certain courses in science, 1889-90 to 1954-55.

Year	Percent of Pupils		
	Biology	Chemistry	Physics
1890[1]	....	10.1	22.8
1900	....	7.7	19.0
1910	1.1	6.9	14.6
1915	6.9	7.4	14.2
1922	8.8	7.4	8.9
1928	13.6	7.1	6.8
1934	14.6	7.6	6.3
1949	18.4	7.6	5.4
1954–55[2]	19.6	7.3	4.6

[1] *Biennial Survey of Education in the United States*, 1948-50, Chapter 5, Washington, United States Government Printing Office, 1951. P. 107. (Federal Security Agency, Office of Education).
[2] Estimate based on this study.

The number of pupils in high school has increased rapidly over the years; therefore, the percentage of pupils in a subject may have decreased and the actual number of pupils increased. This condition exists in chemistry. In biology, both the number and percentage have increased. In physics, the enrollment in 1900 was 98,846 and in 1954 there were 302,800 pupils. During this period the number of pupils taking physics more than tripled, but the percent of pupils declined to 4.6. Of course, we would never expect 100 percent of the pupils in the last four years of high school to be enrolled in physics since those in grades nine and ten would not be eligible. In fact, a percentage of 19 is equal to the total enrollment of the twelfth grade—the grade in which physics is usually taught.

Instead of using all the pupils in the last four years of high school as a base for computation, perhaps it would be easier to understand if the base were the number of pupils in the grade in which the subject is usually taken. For example, the number of pupils enrolled in physics in the fall 1954 was 4.6 percent of all the pupils in high school. Also it was equal to 23.5 percent of the number of pupils in the twelfth grade. It is true that all the pupils enrolled in physics were not from the twelfth grade. Some were from the eleventh grade. Also some of the twelfth grade pupils in 1954 took physics the previous year. However, it is reasonable to assume that 23.5 percent is approximately the percentage of high school graduates in 1954 who have had physics.

Using the grade level enrollment at which the subject is usually taken as the base, the percentages of pupils enrolled in certain science courses in the fall of 1954 are given below.

(a) The enrollment in biology (1,293,900) is equal to 72.6 percent of the number of pupils in the tenth grade.

(b) The enrollment in chemistry (482,700) is equal to 31.9 percent of the number of pupils in the eleventh grade.

(c) The enrollment in physics (302,800) is equal to 23.5 percent of the number of pupils in the twelfth grade.

Similar data on enrollments in high school mathematics in the fall of 1954 are:

(d) The enrollment in elementary algebra (1,204,500) is equal to 64.5 percent of the number of pupils in the ninth grade.

(e) The enrollment in geometry (664,100) is equal to 37.4 percent of the number of pupils in the tenth grade.

The data above are based on a study [3] of a 10 percent randomly selected sample of public secondary day schools.

[3] A complete report of this study is available from the Publications Inquiry Unit, Office of Education, U. S. Department of Health, Education, and Welfare, Washington 25, D. C.

The Development of an Idea:

SCIENCE TEACHER SUMMER RESEARCH ASSISTANTSHIPS

An NSTA Staff Report

ALTHOUGH not entirely a new idea, interest on the part of the National Science Teachers Association in this program can be traced to two circumstances. First, teachers who participated in the 1954 West Coast Science Teachers' Summer Conference, having found their visits and interviews at university research laboratories so informative, recommended that the Future Scientists of America Foundation explore "a plan for more intensive study with an individual research man during the summer." Second, while surveying its program to encourage industry to provide science-related summer jobs for teachers, the Foundation learned that several universities had established a practice of hiring teachers as research assistants through the summer months. On this basis it was recommended to the Administrative Committee and Advisory Groups of the Foundation that such a program should be explored as a part of the 1955 activities of the Foundation. The recommendation was accepted and approved by the NSTA Board of Directors.

In order to proceed with the design of the pilot-run, potential teacher reaction was gauged by correspondence and conversations with several classroom teachers. For example, a biology teacher who has held such an assignment for several summers at the University of Maryland soundly endorsed the idea. He reported that his summer wage had increased gradually through several years to the current level of $250.00 per month.

In order to predict reactions from universities, an interview was arranged with an official of a university who is also quite active in professional public relations organizations. The interview revealed no significant flaws or risks in the program. An executive secretary of an association of colleges and universities endorsed the program and offered assistance in conducting a pilot-run. An executive officer of another large educational organization having its interests primarily in higher educational levels could foresee no weakness in the design of the program. Interviews with the director of science education and head of the division of education in a large eastern university resulted in a pledge of their cooperation in launching the program. In the same city, an engineering department administrative officer endorsed the idea in general but questioned how many such opportunities could be made available in an engineering college.

Acting on the evidence gathered to date, a letter was sent to 20 universities selected simply on the basis of our familiarity with their interest in science and, especially science teaching.

By December 1, six universities reported that they would be willing to go along with the program and six reported they would not. This fact, together with the supporting reasons, was reported to the Foundation's Administrative Committee. The decision was reached to go ahead with the pilot-run and to extend invitations to additional institutions.

Invitational letters were issued to the 111 universities listed in the ninth edition of *Industrial Research Laboratories of the United States* and indicating that they maintain full-scale research activities in all branches of science.

By February 1, twenty-four universities reported that they would be able to provide assistantships.

A tentative draft of the announcement-application form was submitted to contact people at each of the universities. On the basis of their suggestions a final form was prepared.

The participating institutions were listed and application blanks were combined with the announcement form.

Eight thousand copies were printed and distributed, primarily through the membership of the National Science Teachers Association. A news release was prepared and distributed through the National Education Association's Press and Radio Division.

Three hundred sixty-six applications were received. The maximum number indicating first choice for any one university was 41 and the minimum number 3. Characteristics of the applicants can be judged from the sample based on the applicants for three selected universities (Page 91).

The 366 applications from teachers were carefully checked against the requirements for assistantships. Replacements had to be found for some teachers for whom assistantships were available but who had taken on other responsibilities for the summer. Many other details had to be cleared.

Number of applications received	43
Men	27
Women	16
With A.B. degree only	9
With a graduate degree	33
With no degree	1
Average years teaching experience	15
Average age	40
Average number of hours undergraduate science course credit	61
Average number of hours graduate science course credit	14
Major subject of interest	
Biology	24
Chemistry	13
Earth Science	1
Physics	4
Mathematics	1
From within same state as the university	24
Number of states represented	16

By early summer, the following people were at work on eighteen campuses.

The listing that follows gives the name of the university, the campus contact person for the program, the high school science teacher summer research assistant(s), his or her activity, and the faculty person or persons with whom the assistant worked.

CLEMSON AGRICULTURAL COLLEGE, Dean H. J. Webb. Le Roy Pike, Gaffney, S. C.; *Effect on Plants of Sodium, Potassium, Calcium, etc.;* Dr. W. L. Mauldin.

CORNELL UNIVERSITY, President Deane W. Malott. Wanda R. Lundsford, Cincinnati, Ohio; Rosa Isabel Craig, Weston, W. Va.; J. Michael Graves, Charleston, S. C.; *Biochemistry (nutrition);* Dr. Clive M. McCay.

CREIGHTON UNIVERSITY, Dr. C. L. Kenny. Julia Buresh, Omaha, Nebr.; *Organic Preparations;* Dr. P. E. Papadakis.

UNIVERSITY OF FLORIDA, Dr. N. E. Bingham. William P. Rhoads, Gainesville, Fla.; *Components of the Van de Graaff Nuclear Accelerator;* Dr. D. C. Swanson. Paul W. Shank, Oak Ridge, Tenn.; *Amplifier and Radio Frequency Receiver Transistors;* Dr. E. E. Muschlitz. Robert D. MacCurdy, Watertown, Mass.; *Investigation and Preparation of Articles Relating to "Man and Nature in Florida";* Dr. Grobman.

UNIVERSITY OF ILLINOIS, Dean Oswald Tippo. T. A. Nelson, La Grange, Ill.; *Development of Analytical Methods with the Flame Photometer;* Drs. Malmstadt and Laitinen. Glen Tilbury, Champaign, Ill.; *Racemization Studies Using Carbon 14;* Dr. Robert Nystrom.

INDIANA UNIVERSITY, Dean Ralph E. Cleland. Charles B. Bundy, Bloomington, Ind.; *Gamma and Beta Ray Measurements;* Dr. Allan C. G. Mitchell. Grace L. Steiner, Lynn, Ind.; *Histological Preparations;* Dr. Ralph E. Cleland. Alan V. Martin, Santa Fe, N. M.; *Chromatographic and Spectrophotometric Analysis of Flower Pigments;* Dr. Charles W. Hagen.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Dr. George R. Harrison. James N. Mount, Seattle, Wash.; *Apparatus for Microwave Spectroscopy;* James D. Porter, Ventura, Calif.; *Cloud Chamber Observation;* Wendell F. Bennett, Natick, Mass.; *Testing Laboratory Equipment and Wave Guides;* Drs. Harvey and Strandberg. John F. Lafferty, Providence, R. I.; *Measurements of Ultrasound Attenuation in Liquids and Biological Tissues;* Drs. Hueter and Bolt. Ann G. Duffy, Bound Brook, Conn.; *Programming for Whirlwind I Computer;* Dr. P. M. Morse. Joshua L. Miner, Andover, Mass.; *Echelle Spectroscopy and Large Diffraction Gratings;* Dr. George R. Harrison. James R. Espenschied, Hartville, Ohio; *Energy Values from Particle Tracks;* Melvin Rosenstein, Baltimore, Md.; *Effects of High Energy Electrons;* George W. Gallipeau, Jr., Barrington, R. I.; *Measurement of Polarization of 17 Mev Bremsstrahlung;* Dr. Peter T. Demons.

UNIVERSITY OF MIAMI, Dean Charles Doren Tharp. Louis H. Dunlop, McKeesport, Pa.; *Preparation and Purification of Silanes;* Dr. Alfred P. Mills. Aubrey E. Baer, Tulsa, Okla.; *Taxonomy, Morphology and Life Histories of the Trematode Parasites of S. Florida;* Dr. W. H. Leigh.

MONTANA STATE COLLEGE, Dr. Adrien Hess. David R. Pugh, Polson, Mont.; Lynn S. Stein, Sunburst, Mont.; *Radioactive Isotopes;* Dr. Adrien L. Hess.

NEW YORK UNIVERSITY, Dean Harold Torgersen. Russell K. Rickert, Seaford, Del.; *Building and Testing Electronic Circuits;* Dr. James Mulligan. David Christopher, Lindenhurst, N. Y.; *Cross Beam Experiment;* Dr. Lyle Borst.

NORTH CAROLINA STATE COLLEGE, Chancellor Carey H. Bostian. Mary E. Hafling, Birmingham, Ala.; *Nuclear Reactors;* Dr. Clifford Beck.

OREGON STATE COLLEGE, Dean F. A. Gilfillan. Joseph A. Mezzapelle, Turlock, Calif.; *Agricultural Chemistry;* Dr. Joseph S. Butts. Robert F. Koontz, Panaca, Nev.; *Entomology;* Dr. P. O. Ritcher.

UNIVERSITY OF ROCHESTER, Dean Albert Noyes, Jr. Peter H. Nachtwey, Rochester, N. Y.; *Constituents of Crude Calabash Curare;* Dr. V. Boekelheide.

SOUTHERN ILLINOIS UNIVERSITY, Dean Willis G. Swartz. Carl W. Bollwinkel, Shaker Heights, Ohio; *Field Research in Botany;* Dr. John Voigt. George Burton Ellis, Mounds, Ill.; *Research in Chemistry and Nuclear Physics;* Dr. Elbert H. Hadley.

SYRACUSE UNIVERSITY, Dr. Alfred T. Collette. David X. Gilbert, Marcellus, N. Y.; *Phase Diagram Study of Diborane-Methyl Ethyl Ether System;* Dr. Henry E. Wirth.

TENNESSEE AGRICULTURAL AND INDUSTRIAL STATE UNIVERSITY, Dr. William N. Jackson. Burnell W. Simmons, Alamo, Tenn.; *Methods and*

Materials Used in Teaching General College Chemistry and Analytical Chemistry; Dr. C. M. Hill. Luvenia Y. Douglas, Nashville, Tenn.; *Determining Growth Rates and Manners of Reproduction of Fresh Water Forms, Emphasizing Protozoa;* Dr. H. K. Wood. Faye G. Brady, Nashville, Tenn.; *The Response to Androgens of Sub-totally Caponized Cockrels;* Drs. Jackson and Goolsby. Eugene P. Caruthers, Johnson City, Tenn.; Joseph Westbrook, Memphis, Tenn.

TUFTS COLLEGE, Dr. James R. Strawbridge. Michael J. Kenny, Pawtucket, R. I.; *Preparing and Testing Quartz Crystal Specimens;* Dr. C. R. Mingins.

STATE COLLEGE OF WASHINGTON, Dr. A. B. Butler. Howard W. Lawrence, Colfax, Wash.; *Respiration and Ion Up-Take in Plant Tissue;* Dr. Noe Higginbotham. Patricia Packard, Nampa, Idaho; George Frye, Port Townsend, Wash.; *Recent Advances in Science;* Dr. Alfred B. Butler.

The evaluation of the pilot-run of this program required extensive correspondence with all who participated. A quantitative evaluation is almost impossible. It seems best merely to report the values and weaknesses and leave it up to individual teachers and institutions to decide whether or not conditions peculiar to their own cases will enable them to exploit the values and adjust to the weaknesses.

It is possible for teachers to accumulate quite a backlog of undergraduate and graduate courses in science without developing research attitudes and skills. To the extent that such attitudes and skills would improve their preparation of the young people who are at the threshhold of science careers, this program of science teacher assistantships becomes valuable. Not only do the teachers develop these attitudes and skills but they also acquire up to date science information and teaching aids.

The assistants are able to provide help with certain routine operations where constant supervision is not necessary and an extra set of hands is helpful.

The values most consistently reported involve what industrial organizations would simply call public relations. To the extent that the teacher receives a worthwhile experience and becomes familiar with the accomplishments and ambitions of university research laboratories, the teacher becomes an enthusiastic ambassador who will pass the word on not only to his students but also to other teachers. The universities who need a greater number of applicants for graduate student status from which to choose their graduate assistants can well afford to give this program serious consideration.

In addition to numerous administrative details, providing worthwhile assistantships requires careful planning on the part of faculty people. Inadequate briefing on the part of the assistant or the research person can lead to a clumsy period of orientation and, possibly, a feeling on the part of the assistant as to whether or not he should have been there after all.

The participating teachers, university officers, and faculty members whose pioneer spirit fulfilled the purpose of this pilot-run are to be commended. The idea survived. What is most important, the Foundation can now suggest modifications that promise to minimize the weaknesses and exploit the strengths of the program. Universities are being encouraged to provide additional opportunities in 1956. The Future Scientists of America Foundation of the National Science Teachers Association will continue its work toward bringing science teachers and opportunities together.

We are glad to re-affirm our faith in the values of summer research participation for high school science teachers. This faith is now based on experience since we had three participants on our campus during the recent summer.

The services of the teachers at Cornell were valuable in the research projects where the teachers participated. This is shown by the fact that the teachers have been invited to return to the same Department in 1956. Thus both the teachers and the Association should gain stature by encouraging this type of summer activity.

It is the judgment here that additional universities should participate in this method of recognizing, remunerating and improving secondary school science teachers. Furthermore, many universities should be encouraged to provide a larger number of opportunities for the summer of 1956.—LLOYD H. ELLIOTT, Cornell University.

I was one of the Research Assistants on the Foundation program during the summer of 1955. I was assigned to the University of Illinois and worked under the direction of Dr. Malmstadt and Dr. Laitinen. These men seemed to have one objective in mind—to do the best thing for me. My activity consisted of auditing an advanced class in analytical chemistry under Dr. Laitinen and working in the spectroscopy laboratory. I learned to use the flame photometers and worked on a few problems connected with the detection of traces of Fe and Mg in Ti sponge. Another problem consisted of trying to detect qualitatively if Li would replace Mg in a melt of purified LiCl and KCl in an inert atmosphere. All of this was real fun and very informative to me. I also observed other Research Assistants in my laboratory working on problems that employed spark and spray and arc methods of spectroscopy. Everyone was helpful, everyone was friendly. Needless to say, I spent a pleasurable and profitable summer. My instructors always had time to answer questions, discuss problems, and offer helpful hints. I also had ample time to spend in the chemistry library of the University to catch up on many recent developments in chemistry.—T. A. NELSON, Lyons Township High School, La Grange, Illinois.

INCORPORATING CANCER INFORMATION IN THE SECONDARY SCHOOL SCIENCE PROGRAM

By ISRAEL LIGHT

Cancer Reports Section, National Cancer Institute, Public Health Service, U. S. Department of Health, Education, and Welfare

THE EDUCATED PERSON understands the basic facts concerning health and disease, protects his own health and that of his dependents, and works to improve the health of the community. The schools have been considered for many years a key factor in the development of these health standards and attitudes.

The record of disease control in this country is impressive for the infectious diseases, such as pneumonia, tuberculosis, malaria, cholera, and others. As a result, MORE people are living LONGER. For anyone born in the United States in 1789, the average length of life was 35.5 years. But a child born in 1950 could look forward to an average life expectancy of about 70 years. Thus, the average length of life has been doubled during the lifetime of our country. Some physiologists consider it reasonable to work toward a goal of 100 years!

In 1900, only 13.3 per cent of the population were over 50. By 1950, this percentage had risen to 22.5, and in another 20 years it is expected to go up to 26.3. In these 75 years (1900-1975) the proportion of people over 50 is expected to double.

The greatest proportion of illness and death is now attributable to other types of ailments—the chronic, noncommunicable, so-called "degenerative" diseases, such as heart diseases, cancer, arthritis, and muscular dystrophy.

How Widespread Is Cancer?

A unique relationship exists between cancer and age. According to current figures, approximately 65 per cent of all newly-diagnosed cancer cases occur in people over 55. Stated somewhat differently and in more general terms, *the older the individual the greater the risk of developing cancer.* Since this disease is the second most prevalent cause of death (second only to heart ailments), it appears that as people live longer, they are more likely to fall prey to the ravages of cancer. Still, the number of adolescents and young adults who get cancer is not insignificant, and, in fact, the proportion of young people with leukemia is increasing.

In 1955, about 750,000 people were under treatment for cancer. Some 550,000 of these were *new* cases, and the mortality was expected to be approximately 235,000.

It is estimated that more than 40,000,000 Americans *now living* will develop cancer.

Cancer will strike one in every four Americans (at some time).

On the average, cancer strikes about two out of every three American families.

Every day approximately 650 people die of cancer. However, it is a medically proven fact that a direct and favorable relationship exists between the stage at which cancer is discovered and the effectiveness of treatment: the earlier the better, and in some types of cancer a near 100 per cent "cure" possibility.

Why Present Cancer Information in the Classroom?

Effective measures for the control of cancer have their foundations largely in public education. Why? If cancer attacks older people, as a rule, why should the facts of this group of diseases be made known to young people of secondary school age?

The schools are strategic because (a) life-saving treatment depends upon early detection; (b) early detection is a product of family-inculcated and school-emphasized health habits; and (c) the secondary school is still the last formal education for a majority of citizens, and constitutes one of the few non-medically-related places where the individual can get cancer information free from the old wives' tales, emotionalism, and hysteria which so frequently surround references to this disease. These health habits include a regular periodic general physical checkup and positive attitudes toward preventive medicine.

If untreated, cancer leads almost inevitably to death. For most types of cancer there is a close relationship between early detection-diagnosis-treatment and chance for cure. Cancer rarely gives early warning—no pain, no bleeding, no incapacity.

Yet the alert family physician and the trained specialist can notice what the patient overlooks and can more adequately interpret unusual symptoms brought to their attention by the patient than can the patient. Delay in seeking treatment is primarily the fault of the patient because it is the patient who first becomes aware of trouble and who must take the initiative. Very often the difference between being a cancer *patient* (with probabilities of cure) and being a cancer *victim* (death) is the regularity and completeness of physical checkups and knowledge of suspicious symptoms.

It is clear, then, that a combination of health facts and habits, cultivated in the school years, may result in lives saved.

Cancer can be cured by early detection. Early detection is the result of effective health habits and cancer facts. The school is central to this cause-and-effect relationship.

Where Does Cancer Fit into the School Program?

Every effort should be made by the teacher, in the discriminating selection of cancer information, to avoid creating cancer "specialists" or cancer-phobias. There are a number of strategic points in the year's study of science and related subjects where specific reference to cancer serves well to illustrate a principle. The subject might be introduced in several science courses. The following breakdown is suggestive only.

BIOLOGY: (1) cellular organization—normal growth, leading to abnormal growth: (2) physiological aspects—the circulatory system and the distribution of cancer cells in the body; and in secretion—the role of endocrine glands and hormones; (3) reproduction-heredity-theories of cancer origin and susceptibility: (4) care of the body—protection against disease, the nature of cancer, symptoms, diagnosis, and treatment, and the use of drugs (chemotherapy); (5) environment and living things—cancer-causing agents in the environment and various occupations.

PHYSICS: (1) nature of matter—atomic structure, and leading into (2) radiation—in diagnosis, treatment, and research; X rays, radium, and the nature of effects of radiation on tumors; (3) atomic energy—new elements, radioactivity, radioisotopes for diagnosis and therapy, medical research by tracer technique.

CHEMISTRY: (1) chemistry of living things—organic compounds and living processes; (2) drugs and disease—antibodies and antitoxins, vaccines, etc.; use of chemicals in treating cancer (chemotherapy); (3) carcinogens—occupational and industrial hazards.

HEALTH AND PHYSICAL EDUCATION: (1) prevention and control of disease—cancer control programs; (2) preventive medicine—precancerous lesions and suspicious symptoms; (3) physiology—study of cancer as related to the circulatory, secretory, respiratory, and digestive systems.

MATHEMATICS: (1) sources of data—Census of Population, National Cancer Institute, National Office of Vital Statistics, American Cancer Society; (2) problems involving percentages, proportions, rates, cumulative totals, and trends and projections—increasing older population; incidence, prevalence, and mortality rates for cancer; cure rates by age, sex, geographic distribution, and site of disease in the body.

What Are the Objectives for Cancer Information in the Classroom?

The purpose in presenting information on cancer in the public school classroom is three-fold: (a) to introduce *scientifically* valid facts about the disease and to distinguish these from the fallacious notions; (b) to provide background and illustrative materials which emphasize the broad aims and objectives for establishing adequate life-long health habits and standards; and (c) to provide a source of experiments and projects to challenge the bright pupils with a view to having more of them pursue scientific careers.

Fortunately, the aims and objectives in presenting cancer material in the classroom are approximately the same as would be forthcoming from the presentation of facts about many other diseases. The extent and seriousness of cancer and the classic examples provided by the data of this disease are some of the reasons why cancer is presented as a vehicle for the attainment of the following aims and objectives of good health.

1. To impress upon students the validity of the aphorism "an ounce of prevention is worth a pound of cure" by reference to facts as they relate to cancer.
2. To stimulate pupils and their parents to take regular physical checkups.
3. To serve in *applying* the facts of a disease condition to illustrate various *principles* of biology, physics, and chemistry.
4. To provide incentive and motivation for pursuing scientific careers by indicating the nature of cancer research and jobs and occupations requiring science background.
5. To develop an appreciation and understanding of the essential unity, interrelatedness, and interdependence of the scientific disciplines by reference to cancer in the fields of biology, physics, and chemistry.

6. To emphasize the hope for cancer cure rather than the horror of cancer death.
7. To expose superstitions and fallacies about cancer and to give warning about quackery.
8. To develop a more scientific attitude toward cancer and to illustrate scientific methods by presenting the methods of cancer research.
9. To teach students to care for their health more intelligently by early recognition of the abnormal and its possible relation to cancer.
10. To develop an appreciation of the work of various governmental and other agencies in maintaining community health standards in terms of cancer control and research programs.
11. To develop in students the willingness to cooperate in vital community programs and public activities, such as preventive medicine, adult education, and cancer control.

The end product of the integration of cancer information—and information on various other major diseases, for that matter—with the science subjects, is a citizen who will recall his schooling as being of increasing functional value, who will be more interested in and aware of the implications of scientific developments, and who will handle personal problems of health and illness with greater confidence and knowledge.

Laboratory Exercises for the Life Sciences

A SERIES OF EXPERIMENTS, DEMONSTRATIONS, AND NEW IDEAS

We have received many requests for more information about the experiments and demonstrations presented at the Cancer Information Conference held last October 15 at the National Cancer Institute (see *TST* for November, 1955). We are glad to respond by running the entire series of ten in *The Science Teacher*, beginning with this issue and concluding in April and May. This has been made possible by the cooperation of the NCI staff scientists who first prepared the demonstrations for presentation at the Conference and then carefully revised and wrote up the demonstrations expressly for *TST* publication. We want to express our sincere appreciation to these scientists, each of whom is identified in the by-line for his contribution. Teachers may assure their students that these experiments and demonstrations in biology, chemistry, and physics illustrate techniques and lines of investigation actually used by "real, live scientists" in the research work they do at NCI. Please let us know whether our hypothesis is correct; namely, that more laboratory work of this kind in high school science adds realism and kindles the enthusiasm of the students. With your encouragement, *TST* will be on the lookout for more of the same.—*Editor.*

THE USE OF PREPARED MICROSCOPE SLIDES IN THE TEACHING OF SCIENCE

By ROSS C. MAC CARDLE, Ph.D.

Laboratory of Pathology, U. S. National Cancer Institute

THE WIDESPREAD AVAILABILITY of various biological materials in the form of prepared microscope slides provides an excellent source of teaching aids around which can be built the stories of some of the great and fascinating findings of biological science. Many excellent slides can be obtained from biological supply houses, and many more from research scientists in various laboratories and hospitals throughout the country. The latter source is one that has not been utilized appreciably and yet is an extremely valuable potential source of supply. Colored photomicrographs on lantern slides are very helpful.

These slides can be used to relate cell structure to cell function in the body. The following list of topics is given to provide a few suggested areas in which slides can be used profitably to help explain some of the principles of science, along with application:

a. Embryology: Slides of different stages of development of the frog or chick show the

beautifully integrated and dynamic relationships that take place in the development of the fertilized egg through the different stages and on into a young animal. The kidney tubules of a tadpole of a frog before metamorphosis secrete chiefly ammonia, whereas the frog secretes urea in the urine.

b. Tissue culture: Slides of different tissues grown in culture can be compared with slides of the corresponding tissues as they grow in the body to illustrate how tissues change their form and rate of growth when placed in a different environment. With some slides the effect of different nutrients could be demonstrated (for other relationships, see the write-up on Tissue Culture).

c. Tumor tissue: Slides of tumors compared with those of the corresponding normal tissues can be used to demonstrate how the normal structure changes when the tissue become malignant. For example, a simple section of normal human skin could be compared with the remarkable downgrowth of epidermis into the dermis of a human basal-cell tumor.

d. Comparative anatomy: Slides of a given tissue from different species of plants and animals can be used to show how structure varies from one species to another. Likewise, whole mounts of small animals are useful in comparing the structures of one animal to those of another.

e. Liver: Slides of liver tissue can be used to show changes in structure as related to different functional states of the organ. For example, sections of liver fixed in 95% alcohol to precipitate the glycogen and colored with Best's Carmine show glycogen granules, and can be used to relate the amount of glycogen in the liver in different nutritional states of the animal. The liver of starved mice lacks glycogen.

f. Pancreas: Slides of pancreas fixed in Zenker's fluid and colored with Gomori's aldehyde fuchsin can be used to show how a glandular organ can produce from acinar cells materials secreted through ducts into the intestine (the pancreatic digestive fluids), and also produce from cells of islets of Langerhan's different materials (hormones—in this case, insulin) to be carried away by the blood stream. If these latter cells are destroyed, diabetes mellitus develops because without insulin the liver is unable to store excess incoming sugar as glycogen, and it is eliminated in the urine.

As an example of a story to be told utilizing slides, the following account of the anterior portion of the pituitary gland is given:

Function of the Anterior Lobe of the Pituitary Gland

History:

Much of our knowledge of the growth hormone produced by the anterior lobe of the pituitary gland was first described by Pierre Marie in 1885 who discovered that the abnormal condition of *acromegaly* is due to excessive elaboration of the growth hormone in adult life after the usual age of full skeletal growth has been reached. Marie found that a tumor of the anterior lobe composed of alpha cells [1] is responsibile for the excessive secretion. This was the first demonstration that the alpha cells produce growth hormone. *Acromegaly* in adulthood is manifested by increase in width, not length, of bones such as those of the hands, and the face. *Gigantism*, on the other hand, begins in early stages of development, perhaps before birth. A pituitary tumor of the alpha cells produces excess growth hormone, resulting in growth in length—the bearer of it reaching 7 or 8 feet in height (in man). The discovery of this tumor led to experiments in animals on effects of removal of the pituitary gland. If accomplished early after birth, removal of it (hypophysectomy) inhibits growth to form a dwarf. It is of interest that a dwarf strain of mice exists in nature that lacks alpha cells in the anterior lobe of the pituitary gland.

In 1949, Gorbman and others at the Oak Ridge National Laboratory in Tennessee found large malignant tumors of the anterior lobe of the pituitary glands of mice that had been treated with radioactive iodine. This radioactive iodine is absorbed extensively by the thyroid gland, and the accumulated radioactive substance gradually destroyed the thyroid gland (radiothyroidectomy), thus inducing the pituitary gland to become hyperactive to produce more of the governing thyroid stimulating hormone [2] for a thyroid gland that was not there, so to speak. In the process of hyperactivity, the anterior lobe of the pituitary grew and became

[1] Alpha cells sometimes designated also as acid-phils are cells that usually retain acid dyes but also color with basic dyes as safranin.

[2] This hormone, the thyroid stimulating hormone (TSH), is one of a number of hormones normally produced by the anterior lobe of the pituitary gland.

A program of teacher awards to encourage the reporting and dissemination of outstanding science teaching ideas

★

Conducted by the National Science Teachers Association under a grant from the National Cancer Institute

Entries may be based on teacher demonstrations, laboratory exercises, or other activities commonly employed in effective science teaching

S T A R

Science Teacher Achievement Recognition Awards

'56

Recognition will be in the form of cash awards, trips to Washington, D. C., medallions, and plaques

★

Closing date for receipt of entries:

DECEMBER 21, 1956

Science Teacher Achievement Recognition

WHAT ARE THE PURPOSES OF *STAR*?

This program of Science Teacher Achievement Recognition awards is designed to stimulate and recognize superior science instruction in grades 7 through 12 in public, private, and parochial schools. STAR is planned to encourage the development of creative ideas, teaching materials, and teaching techniques, and to secure the widest possible dissemination of such, for the purposes of:

- Raising the general level of science instruction.
- Influencing more young people to enter the fields of science and science teaching.
- Helping young people to understand that the key to our science problems is more and better basic research.
- Developing understanding that many fundamental science problems (such as the control of cancer) require the cooperative attack of specialists in fields as diverse as physics, botany, mathematics, chemistry, physiology, genetics, and bacteriology.
- Developing a thorough understanding of the basic principles of biological and physical science and their application to such fields as health through presently established courses.
- Developing more reflective and critical habits of thought.
- Helping young people gain skill in scientific problem solving.

WHO IS SPONSORING *STAR*?

STAR is supported by a grant from the U. S. National Cancer Institute to the National Science Teachers Association. The National Cancer Institute made this grant because it appreciates the importance of the science teacher in developing a pool of young scientists from which may be recruited future leaders in research, science teaching, and other scientific professions.

WHAT KIND OF ENTRY MAY I SUBMIT?

The following illustrate types of activities, reports of which are suitable for submission as entries in *STAR*:

- Teacher demonstrations
- Laboratory exercises
- Motivation devices
- Pupil projects (individual and/or group)
- Lesson plan outlines
- Use of community health resources

It is emphasized that participants in STAR are restricted in no way as to content areas. Cancer information and materials are available, however, as a medium to serve and enhance the larger aims and purposes of STAR for those who may wish to use such materials as their vehicle in participating in this program.

HOW WILL THE ENTRIES BE JUDGED?

Entries should be related to one or more of the stated purposes of STAR. Submissions will be judged on the basis of resourcefulness in terms of ingenuity and the most effective use of available facilities; creativeness; completeness in conception and presentation; accuracy; and utility for application in other teaching situations.

HOW WILL WINNING ENTRIES BE RECOGNIZED?

10 $200.00 awards

or

3-day all-expenses paid, sponsored trips to Washington, D. C., including visits to scientific and educational institutions

50 Medallions to individual winners

50 Plaques to schools represented by the medallion winners

Award-winning entries will be published in a brochure, in *The Science Teacher,* and in other journals.

STEPS IN *STAR:*

1. **Fill in coupon and mail to receive materials**
2. **Classroom-test your idea(s)**
3. **Submit *two*, double-spaced, typewritten copies of your report. Photographs and other illustrative materials may be included as part of the report.**
4. **Entries must be postmarked not later than *December 21, 1956*.**

MAIL TO:

STAR Awards
National Science Teachers Association
1201 Sixteenth Street, N. W.
Washington 6, D. C.

Clip and mail to:

National Science Teachers Association
1201 Sixteenth Street, N. W.
Washington 6, D. C.

☐ I plan to participate in the 1956 STAR Awards Program with an entry from
☐ general science ☐ biology ☐ chemistry
☐ physics ☐ other: .....

☐ Send me the free packet of selected cancer information and educational materials.

Name .....

School .....

School Address .....

City and State .....

1. Pupil population of your school:
   ☐ under 300 ☐ 300-1000 ☐ 1000 or more
2. How many years have you been teaching science? ..... years
3. Your total daily teaching load in science:
   ..... pupils ..... classes
4. By your own standards, how would you rate the science teaching facilities and resources of your school?
   ☐ meager ☐ adequate ☐ exceptional

Sponsored by

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NATIONAL CANCER INSTITUTE

1956 STAR AWARDS
for
SCIENCE TEACHERS

malignant in the form of a tumor that produces about 10 times more thyroid stimulating hormone (TSH) than the normal gland. The tumor can be transplanted to a host mouse of suitable strain that has been pretreated with radioiodine—and it is thus dependent upon radiothyroidectomy. Hence, we may now be able to determine the cellular origin of TSH in the mouse by identifying the type of cell constituting the tumor—just as Pierre Marie did 70 years ago for the growth hormone in man.

Demonstration:

Histological preparations of tissues of the normal and tumor-bearing mouse fixed in Cajal's uranium-mitrate-formalin fluid and colored by Masson's trichrome method show the brilliant rose-colored alpha cells of the normal pituitary gland, the cellular changes in hyperactivity during radiothyroidectomy, and the sky-blue colored cells of the dependent malignant tumor of the pituitary gland. Such slides could be obtained from biological supply houses at very reasonable cost. One set of 3 or 4 slides would suffice for a class of 25 students, and the slides would be a permanent collection. Lantern slides of regular size or kodachrome slides of photomicrographs of the preparations can also be obtained for lecture. A limited number of host mice bearing transplants of pituitary tumors could be obtained from individual investigators. Hypophysectomized rats can be readily obtained from biological supply companies to observe the effects of removal of the pituitary gland. Two or 3 hypophysectomized rats would be sufficient, or perhaps lantern slides showing the animals could be used instead. Dwarf mice can also be obtained from laboratories but with more difficulty because of their small size and delicate nature. Perhaps lantern slide photographs of them would suffice.

THE INDUCTION OF CANCER BY A VIRUS

(Rous Sarcoma Virus)

By W. RAY BRYAN, Ph.D.

Laboratory of Biology, U. S. National Cancer Institute

Principles: Cancer can be induced by different types of agents, such as certain chemical compounds, radiation, and a few viruses. These latter materials are produced in living organisms, are cell-free, large-molecular compounds made up to a large extent of nucleoprotein, and can be purified by means of very high speed centrifugation. One of these viruses, the Rous sarcoma virus, is a tumor-producing agent highly specific for chickens, and, after injection of the purified material into the muscle or subcutaneous tissues of a young chicken, tumors appear within a few days and kill the animal in about three weeks.

One of the first such chicken cancers to be studied was that described by Dr. Peyton Rous, of the Rockefeller Institute for Medical Research, in 1911. Although only weakly active when first isolated from a naturally occurring cancer (in a Plymouth Rock hen), the extractable agent which induces the new cancers has greatly increased in its potency during passage in the laboratory for more than 40 years. It is now capable of producing grossly visible cancers within 5 to 10 days, when strong doses of it are injected into young (2 to 8 week-old) chicks. The cancers grow very rapidly after they appear at sites of injection of the agent and usually kill their hosts within 2 to 4 weeks.

The agent which causes the cancers can be separated from the tissue extracts by ultracentrifugation. Its unit-particle size as well as other characteristics place it in the category of the "filterable viruses." Unlike the viruses of infectious diseases (e.g. influenza, common cold, polio, etc.), however, the Rous sarcoma virus is highly specific for chickens, or closely related fowls, and will not cause cancer in human beings or any other mammal. Furthermore, the cancerous disease produced in chickens is not contageous, the only known means of transfer of the agent from one chicken to another being via the syringe and needle of the laboratory worker.

The demonstration reported is designed to show: (a) the preparation of suspensions of the virus for injection; (b) the method of injection; and (c) the production of typical early cancers and older cancers after progressive periods of growth in chickens that were injected from 5 to 20 days prior to the time of the demonstration.

Procedures: Most commercial stocks of chickens can be used for the experiment, although some are somewhat more susceptible to the virus than others. The most desirable age of the chickens is 3 or 4 weeks. Virus in lyophilized form is reconstituted

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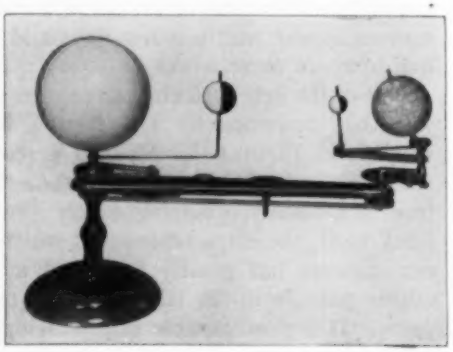
Trippensee Planetarium



No. 708. This demonstration device shows the relative position and motion of the Sun, Earth, Moon, and planet Venus. Simplifies teaching the rotation of the earth, the annual revolution around the Sun, day and night, change of seasons, and the mechanics of eclipses. Constructed of brass with chain drive gears. Arm length is 16½", overall height 16". Hand operated. **$85.00**

by the addition of distilled water (1 or 2 cc. per vial) and thoroughly resuspended by drawing back and forth into a syringe with attached hypodermic needle. After a few minutes the suspension is ready for injection. It may be further diluted to 10 cc., with water, if a larger volume of the suspension is desired. Although it is stable for years in the dried (lyophilized) state, after resuspension in water the virus retains its biological activity for only a few hours.

The anterior, feather-free surface of the wing, or the wing web, is a suitable site for observing early cancers. The needle is passed through the skin and some muscle tissue a short distance from the desired site of delivery, and the point of the needle is then brought back into the subcutaneous space for delivery at the desired site. About 0.2 to 0.5 cc. of the virus suspension is delivered and the needle is withdrawn. The muscle tissue acts as a valve to prevent back leakage of the injected material through the needle tract. The wing may be swabbed with 70% alcohol prior to the injection but the site should be allowed to dry before inserting the needle. No further treatment is necessary. Beginning on the 5th day after inoculation the inoculation site on each chicken should be examined daily for the appearance of a small raised nodule, or multiple small nodules which grow progressively in size. In view of the variation in susceptibility among individual chickens, at least 4 or 5 should be inoculated. An occasional chicken in most strains may be entirely resistant to the virus and the more resistant strains of chickens may require longer (e.g., 7 to 10 days) to develop lesions than highly susceptible strains (e.g., 5 to 7 days).

Materials needed:

Chickens. Two to 8-week-old chicks (preferably 3 to 4 weeks). Most commercial breeds and strains are satisfactory.

Lyophilized virus. Available in ampules from the American Type Culture Collection, 2029 M Street, N. W., Washington 6, D. C. (This is a non-profit registry subsidized by several scientific societies and organizations. Materials are supplied to high school teachers at a reduced fee.)

Distilled water (should be boiled if not fresh).

Syringe and needle. The syringe should be 1 or 2 cc. and the needle of 18 to 24 gauge, at least 1 inch in length.

REPRESENTATIVE SOURCES FOR SUPPLIES

General laboratory supplies such as slides, coverslips, microtomes, etc.:

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Rous sarcoma virus:

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(Also check advertisements in *Scientific American* and *Science*).

To be continued in the April and May issues of *The Science Teacher*.

HEROLD C. HUNT, *Under Secretary,* Department of Health, Education, and Welfare, Washington, D. C. Convention keynote address, Wednesday evening, March 14; "Problem Solving for Learning and Living."

PHOTO SECTION, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

STEPHEN M. COREY, *Dean,* Teachers College, Columbia University, New York City. Address to general session for high school and college, Thursday morning, March 15; "Learning How to Find Out in High School and College Science."

FLETCHER G. WATSON, *Associate Professor of Education,* Harvard University, Cambridge, Mass. Address to general session for elementary, Thursday morning, March 15; "Learning How Children Learn." Presentation at Concurrent Symposium 1: "Using Case Studies and the Historical Approach in Science Teaching," Thursday afternoon, March 15.

WILLIAM N. JACKSON, *Head,* Department of Science Education, Tennessee A. and I. State University, Nashville. Presentation at Concurrent Symposium 2: "Developing Problem Situations for Learning," Thursday afternoon, March 15.

A. HARRY PASSOW, *Research Associate,* Horace Mann-Lincoln Institute of School Experimentation and *Associate Professor of Education,* Teachers College, Columbia University, New York City. Presentation at Concurrent Symposium 3: "Problem Solving for Rapid Learners," Thursday afternoon, March 15.

Highlights of the 1956 Convention

PAUL DE H. HURD, School of Education, Stanford University, Calif. Presentation at Concurrent Symposium 4: "School Facilities for Problem Solving," Thursday afternoon, March 15.

ERNEST E. BAYLES, *Professor of Education,* The University of Kansas, Lawrence. Presentation at Concurrent Symposium 6: "Training Teachers for Reflective Thinking," Thursday afternoon, March 15.

ROBERT H. CARLETON, *Executive Secretary,* National Science Teachers Association, Washington, D. C.; Brief report to general session, Thursday evening, March 15; "This Is Your NSTA—NEA—AAAS."

WILLIAM G. CARR, *Executive Secretary,* National Education Association, Washington, D. C. Brief report to general session, Thursday evening, March 15; "This Is Your NSTA—NEA—AAAS."

CHASE NEWS PHOTO

DAEL WOLFLE, *Administrative Secretary,* American Association for the Advancement of Science, Washington, D. C. Brief report to general session, Thursday evening, March 15; "This Is Your NSTA—NEA—AAAS."

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REGINALD G. SLOANE, *Chairman,* B-I Executive Committee, Business-Industry Section of NSTA; Standard Oil Company (New Jersey), New York City. Presiding officer of National meeting on Thursday, March 15.

RALPH E. GIBSON, *Director,* The Johns Hopkins University Applied Physics Laboratory, Silver Spring, Md.; President, Washington Academy of Sciences. Address to Concurrent Session 3: "A Systems Approach to Scientific Research," Friday afternoon, March 16.

JOHN R. HELLER, *Director,* National Cancer Institute, Bethesda, Md. Address to Concurrent Session 1: "The Potential of Research in the Life Sciences for the Science Teacher," Friday afternoon, March 16.

PHOTO SERVICES AND RESEARCH SECTION
NATIONAL INSTITUTES OF HEALTH

Washington, D. C. March 14-17

GEORGE W. IRVING, JR., *Deputy Administrator,* Agricultural Research Service, U. S. Department of Agriculture, Washington, D. C. Address to Concurrent Session 2: "Agriculture—Where the Sciences Meet," Friday afternoon, March 16.

SAMUEL LENHER, *Vice-President,* E. I. du Pont de Nemours & Company, Inc., Wilmington, Del. Convention banquet address, Friday evening, March 16; "A New Horizon for Scientific Education."

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RALPH W. TYLER, *Director,* Center for Advanced Study in the Behavioral Sciences, Stanford, Calif. Address to general session, Saturday morning, March 17; "Evaluation in Relation to Problem Solving."

FABIAN BACHRACH

HERMAN SCHNEIDER, City College of New York, N. Y. Demonstration for elementary teachers, Saturday morning, March 17; "Improvising Simple Learning Materials."

W. W. GRIGORIEFF, *Chairman,* University Relations Division, Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tenn. Address to morning session of American Association of Physics Teachers (Chesapeake Section), Saturday, March 17; "Oak Ridge Programs of Aid to Science Teachers."

Highlights of the 1956 Convention

JOSEPH KAPLAN, *Chairman,* U. S. National Committee for the International Geophysical Year, National Academy of Sciences, Washington, D. C. Address to morning session of American Association of Physics Teachers (Chesapeake Section), Saturday, March 17; "The International Geophysical Year."

ALAN T. WATERMAN, *Director,* National Science Foundation, Washington, D. C. Luncheon address, American Association of Physics Teachers (Chesapeake Section), Saturday noon, March 17; "What Should the Federal Government Do for Science Teachers?"

HARRY MILGROM, *Supervisor of Science,* New York City Elementary Schools. Director of "Here's Why I Do It" session for elementary science, Saturday afternoon, March 17; "Make It and Take It" Workshop.

LORSTAN STUDIOS

GLENN O. BLOUGH, *Associate Professor of Education,* University of Maryland, College Park; member of convention program committee. Director of "Here's Why I Do It" session for general science, Saturday afternoon, March 17.

FABIAN BACHRACH

RALPH W. LEFLER, *Assistant Professor of Physics and Education,* Purdue University, Lafayette, Ind. Director of "Here's Why I Do It" session for physics, Saturday afternoon, March 17; "Teaching High School Physics to Encourage Student Investigation."

HUBERT N. ALYEA, *Professor of Chemistry,* Princeton University, N. J.; member of convention program committee. Director of "Here's Why I Do It" session for chemistry, Saturday afternoon, March 17.

HENRY A. SHANNON, *Adviser in Science,* State Department of Public Instruction, Raleigh, N. C. Chairman of convention planning committee; will "open" the convention at the general session, Wednesday evening, March 14.

WALLER STUDIO

ROBERT STOLLBERG, *Professor of Science and Education,* San Francisco State College, Calif. President of NSTA; will preside at general session, Wednesday evening, March 14; will serve as toastmaster at annual convention banquet, Friday evening, March 16; and will serve as discussion coordinator at Concurrent Session 3: "A Systems Approach to Scientific Research," Friday afternoon, March 16.

ELLSWORTH S. OBOURN, *Specialist for Secondary School Science,* U. S. Office of Education, Washington, D. C. Platform guest, Thursday morning, March 15; Will serve as discussion coordinator at Concurrent Symposium 1: "The Potential of Research in the Life Sciences for the Science Teacher," Friday afternoon, March 16.

HOWARD EARL DAY

NSTA Activities

Moving Day at NSTA

February 27, 1956 is a date to be remembered. On that day, NSTA forsook its "four rooms and three baths" in the Martinique Hotel and moved into 1,000 square feet of modern office space in the new, air-conditioned NEA Educational Center. Our unending thanks go to the thousands of teachers whose NEA Life Memberships, contributions, and pledges have made possible this beautiful, functional headquarters for nearly 600 staff members of the NEA and its departments, divisions, committees, and commissions.

There are many values associated with NSTA's departmental status in NEA: easy and effective communication with all segments and levels of the educational profession; a location in Washington along with dozens of other scientific and educational groups; and the provision of rent-free space and office facilities. The latter, plus utilities and related services, would cost NSTA at least $7500 a year, or more than one dollar per individual member, if we were not part of the NEA.

You can show your appreciation and give support for the continuation of this assistance by being a member of NEA. Better still, make it a Life Membership; and then give to the building fund as your interest and circumstances permit. If you want to do these things *through NSTA*, your staff will be glad to help you.

Field Activities

An important phase of NSTA action not readily discernible to members is field service and cooperation with other groups. In the main, this work is carried on by the Executive Secretary. You may be interested in a brief run-down of such activities during the past few weeks. Since the goal of this activity is to enhance and advance the profession and to benefit all science teachers, even though indirectly, your evaluation and advice will be most welcome.

January 11. Atlanta, Georgia. All-day conference with State Department of Education on proposed science curriculum development project.

January 14. Philadelphia, Pennsylvania. Participation in television program on "The Search for Scientists"; sponsored by New Jersey and Pennsylvania Education Associations.

January 16. Washington, D. C. Participation in all-day conference of directors of science teachers' summer institutes sponsored by the National Science Foundation.

January 19. Washington, D. C. Member of an advisory group asked to "react" to ideas suggested for a project of Scientific Apparatus Makers' Association.

January 24. New York City. Meeting of twenty business-industry representatives to consider an NSTA proposal for a science teaching improvement project designed chiefly for elementary and junior high schools.

January 31. New York City. Guest-speaker at luncheon meeting of New York chapter of NSTA's Business-Industry Section.

February 1. New York City. Conference with representatives of a business corporation considering financial support for certain NSTA-FSAF projects.

February 3. Pittsburgh, Pennsylvania. All-day conference of a special committee on scientific manpower in fields of metallurgy and ceramics.

February 6-7. Oak Ridge, Tennessee. Meeting of an advisory committee on plans to launch the Oak Ridge Institute of Nuclear Studies' 1956-57 program of traveling science-teacher demonstrators.

February 9-10. Chicago, Illinois. Attendance at Military-Industrial-Education conference on "National Survival in the Nuclear Age"; NSTA was one of more than thirty co-sponsoring groups.

February 22. New York City. Participation in meeting of the Technical Association of the Pulp and Paper Industry; two members of TAPPI—the Crown Zellerbach Foundation and the Marathon Corporation —have sponsored summer conferences for science teachers through NSTA's Future Scientists of America Foundation.

Data Wanted

NSTA and its Future Scientists of America Foundation are now engaged in a two-pronged survey to secure some greatly needed information.

First is a name list of teachers of science in junior and senior high schools. The list, *to be under full control of NSTA*, will be coded as to subjects taught and other factors. The list should have extensive use in sending teachers announcements of summer opportunities, student guidance materials, and other such items.

Second is comprehensive data on enrollments and offerings in major science courses in junior and senior high schools. No major nation-wide study of this kind has been done in years.

Please encourage your principal to send a full reply *promptly* when the request form is received.

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FSA Activities

Datelines and Deadlines

March 20. Last day to submit applications for summer research assistantships.

March 20. A supplemental list of teachers who want summer jobs, research assistantships, or to take part in special summer conferences will be sent to sponsors.

April 1. The winning students in the FSA Chart-Making Contest will be notified.

April 20. Applications for the 1956 West Coast Science Teachers' Summer Conference must be postmarked.

April 25. The winning students in the Science Achievement Awards Program will be notified.

Why and Wherefore

What should the Future Scientists of America Foundation do with the money it receives from contributors? Are its programs the ones science teachers really want? Are there better ways to help teachers turn out capable students who want to become scientists? We must keep these questions constantly in mind. We think we know the right answers but we may be wrong. The least we can do is to share with you the philosophy and basic assumptions behind each program.

Science Teacher Recruitment

The booklet, *Careers in Science Teaching*, shows science teachers in their customary roles. They are portrayed as members of a successful and appreciated profession. The thousands of competent young scientists on their jobs in America bear witness to the success of their teachers.

Tomorrow's Scientists

The methods scientists use, their training and experience, and why they are doing what they do are of interest to young people and may help them find a place in the scientific enterprise.

Science Related Summer Jobs for Teachers In Industry

Teachers can successfully hold many types of industrial jobs. They can fill vacation vacancies. They most surely need the additional income. It is an advantage to them to see some of the next steps that are ahead of their students. Industrial science can give added meaning to the academic training they already possess.

Encouraging Future Scientists: Materials and Services Available in 1955-56

It is easier for teachers to acquire counseling aids and take advantage of sponsored services if the notices of their availability are brought together in one booklet.

Science Achievement Awards for Students

Practicing scientists gain much of their motivation from the sheer satisfactions of invention and discovery. The sooner young people can taste these satisfactions, the sooner they will develop lasting interests in the study of science and science careers. Without the ability to report their activities to others, even the best scientists become ineffective.

Student Chart-Making Contest

Graphically portraying an idea helps one to understand and appreciate it.

Fellowships for Summer Conferences

To maintain its vigor, the science teaching profession needs research into how and why students learn science. Unless the research is done by teachers, there is the risk that the results will not be practical. Unless teachers have access to new information, they are likely to reshuffle or rehash hopes and prejudices with which everyone is already familiar.

Science Teacher Summer Research Assistantships

For reasons entirely beyond their control, many fully qualified teachers have not had an opportunity to participate actively in genuine research projects.

Roster of Sponsors

We are happy to announce that the following organizations have joined the Foundation's Roster of Sponsors since the February issue of *The Science Teacher* went to press:

Allied Chemical & Dye Corporation
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Experiments with Atomics—Beeler & Branley	2.50	Careers in Science—Pollack	3.75
General Science Projects—Bailey & Chiddix	2.10	Dinosaur Book—Colbert	5.00
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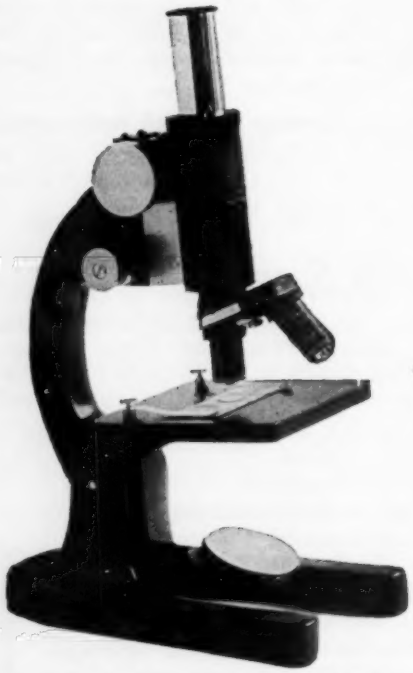

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Classroom Ideas

Physics

Determining the Frequency of a Vibrating String

By HARRY E. CRESSMAN, Pennsauken, New Jersey

To state the laws of vibrating strings is a fairly simple matter but to demonstrate them is certainly more challenging and frequently altogether disappointing. Moreover, the methods usually listed in high school laboratory manuals leave much to be desired. The outcome of some thought on this matter was a method which proved more satisfactory for us and certainly much more exciting and less frustrating for the pupils.

Briefly, the method used was one of comparing the unknown frequency of the vibrating string with that from a tunable, calibrated audio-oscillator through the medium of a five-inch oscilloscope.

The procedure was simple enough for any pupil to follow. The string was plucked; the audio-oscillator tuned until a readable Lissajou's pattern appeared on the screen of the oscilloscope. From this pattern the unknown frequency of the vibrating string was determined.

In more detail, the materials and equipment used were a sonometer with two strings each one meter long (effective lengths could be varied by use of the bridge) but having different masses. Each string was attached at one end to a turnbuckle and at the other end to a tension balance. Obviously, the three factors (length, mass, and tension) affecting the frequency of vibration of a string could easily be changed and the results studied. The calibrated audio-oscillator had a range from zero to 20,000 cycles per second and its frequency could be continuously varied between these extremes. The five-inch oscilloscope, like the audio-oscillator, was bought as a kit and assembled by the instructor. The other materials were a single-pole, single-throw switch, old audio transformer with a turns ratio of about 1 to 4, telephone transmitter, three to four dry cells, and connecting wire.

The apparatus was assembled in the following manner. The output from the audio-oscillator was connected to the vertical input terminals of the oscilloscope. The secondary coil of the transformer was connected to the horizontal input terminals of the scope. The dry cells, switch, and telephone transmitter, connected in series, were attached to the primary coil of the transformer. Finally, the telephone transmitter was clamped to a ringstand and placed near the vibrating string. Permitting the transmitter to touch the resonating box beneath the string will increase the intensity of the pickup.

To operate, simply turn on the current to the audio-oscillator and oscilloscope, close the switch in the transmitter circuit, set the string to vibrating, and then vary the frequency of the audio-oscillator until a motionless circle appears on the screen of the oscilloscope. Now read the setting of the dial on the audio-oscillator. This reading is the frequency of the vibrating string within the tolerance of the equipment.

A typical set of data follows:

String Diameter(cm)	*Tension(kg)*	*Length(cm)*	*Frequency (cycles/sec)*
.071	9	100	82
.071	9	50	168
.071	8	100	76
.033	9	100	183
.033	9	50	360
.033	10	100	200

String diameter was substituted for square root of mass.

From the data to within close approximation, the frequency varies inversely with the length of the string, inversely with the diameter or square root of the mass, and directly with the square root of the tension. I simply recommend this method for the following reasons.

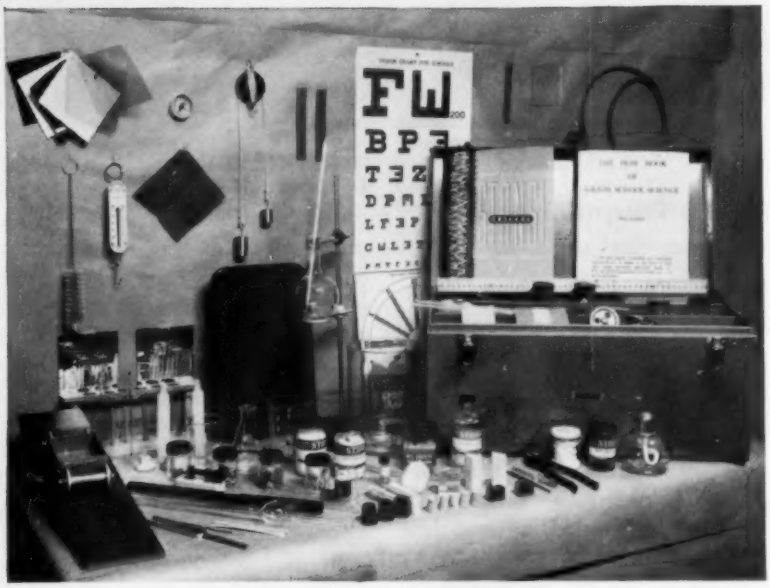
1. It permits the pupils to do this experiment visually which in many instances is a distinct advantage.

2. The data the pupils obtain are, for the most part, more reliable and more conclusive. The results usually are in better agreement with the established facts about vibrating strings.

3. Interest in this particular experiment is greatly increased.

4. This method demonstrates to the pupils a way to use the audio-oscillator and oscilloscope, while at

WHAT'S NEW AT STANSI?



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the same time it whets their interest in these instruments and, quite possibly, in the related fields in physics.

5. Finally, for those teachers who already have this equipment this method should provide another opportunity to use it.

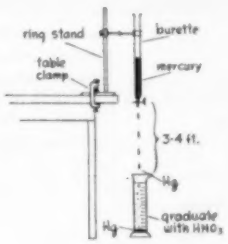
Chemistry

Cleaning and Purifying Mercury

By THOMAS P. BENNETT, Winter Haven, Florida, High School

Most laboratories have on hand a supply of mercury that has become dirty through use in a barometer or other instrument; perhaps it has formed an amalgam. When this situation arises a simple device can be set up for cleaning the mercury with the minimum of time and chemicals.

The apparatus needed is as follows: a graduated cylinder larger than 500 ml., nitric acid solution of 25 per cent concentration in water, a burette with stopcock, and a burette holder.



The setup is very simple. The burette is supported in a position about three feet above the graduated cylinder, which is filled to the 300-500 ml. mark depending on the amount of mercury to be used. The mercury is carefully poured into the burette so as not to break the burette, and the stopcock is adjusted so that a very slow stream of mercury flows. Allow this to drop into the graduate of nitric acid. If the flow is regulated correctly, very minute drops of mercury will hit the nitric acid, burst into smaller particles, and pass through the nitric acid. A chemical reaction occurs between the nitric acid and the mercury amalgam.

Retrieve the mercury after all of it has passed through the nitric acid and repeat this process.

The next time you retrieve the mercury proceed in a similar manner but substitute distilled water for the nitric acid.

The mercury is then dried by filtration and slowly heated to drive off the remaining water.

General Science

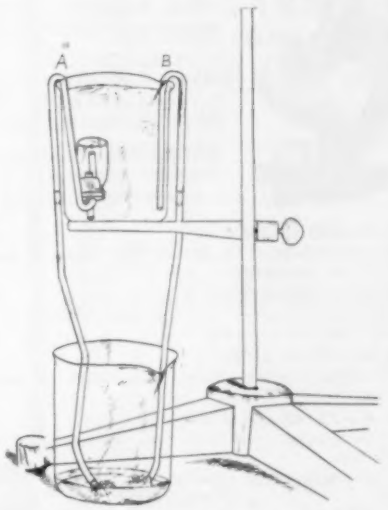
A Self-Starting Siphon

By ROBERT MCCAFFERTY, High School, Wadsworth, Ohio

and

DOUGLAS HUDSON, High School, Bellport, Long Island, New York

Let's think of the students who have shown little interest for academic work, but nevertheless come to the laboratory to test some of the laws of nature. When one of these folks exhibits superior manual dexterity, we may offer a special word of encouragement and guidance: "You're not doing what I suggested, but go ahead and let's see what happens. What laws in nature may be proved by your setup? Why don't you go to the library and find what others have done in that connection?" By this time the student will be spending an extra period per day on his project, and he will be happy to serve as laboratory assistant. Our last such student, Richard Chesser, was working with gravity, impenetrability, and the cohesive tendency of molecules of water, when he accidentally made a self-starting siphon, as is shown at A in the illustration. He later found that the U-tube which is shown at B will work as a self-starting siphon when it is quickly



These self-starting siphons function when the beaker is nearly full of water. The U-tube at B must be thrust into the water or the outlet end must be held closed until the vessel end is inserted. *Drawing by George Mustric, Wadsworth High School student.*

thrust into a *full* beaker of water. Richard experienced accidental discovery. He found, nevertheless, that his work was not original, because numerous such devices have been devised (Encyclopaedia Britannica). He learned that his siphons are self-starting, because in each setup "air is trapped in the vessel end (of the U-tube as it is inserted into the liquid) and the air bubbles lift the liquid over the top and start the flow." (Albright, John G., *College Physics*, The Ronald Press Co., N. Y., 1948.)

Further study revealed the following: "(1) The flow of water through siphons is subject to the laws obtaining in pipe flow. (2) The motion of water around the bends of a siphon approximates to that of a free vortex. (3) The pressure in the outlet leg of the siphon changes its character, as compared with atmospheric pressure, from suction to positive pressure at such a mean level that the vertical distance between the water level upstream of the siphon and the mean level at which the change takes place provides an exact measure of the loss of pressure head down to that level. . . . The flow through siphons is consistent and amenable to mathematical analysis." (Davis, P., "Laws of Siphon Flow," *Engineering*, 135: 115-116, Jan. 27, 1933.)

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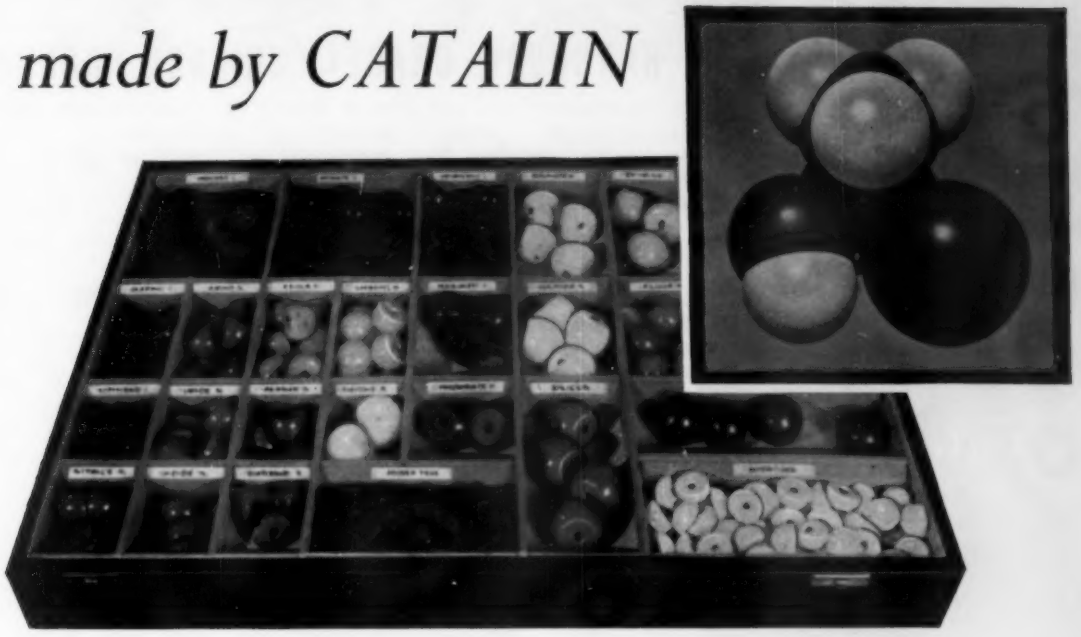

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Book Reviews

THE NEW BASIC SCIENCE. J. Darrell Barnard and Lon Edwards. 632 pp. $4.20. The Macmillan Company, New York. 1956 (Revised Edition).

This book is conspicuous for its comprehensive content and the large number of well chosen illustrations. The detailed explanations and procedures concerning experiments will do much to assist the busy teacher to provide opportunities for those boys and girls who like laboratory activity.

Other features of this book include the unit activities, the chapter tests and the bibliography for further reading. Teachers of seventh and eighth-grade science will appreciate having one or more copies of *Basic Science* on their reference shelves. Many ninth-grade teachers will find it suitable as a basic text.

CLIFFORD R. NELSON
Junior High School Science Consultant
Newton, Massachusetts

THE HIDDEN LIFE OF FLOWERS. J. M. Guilcher, Photography by R. H. Noailles. 93 pp. $4.75. The Philosophical Library, New York. 1954. (Translated from the original French.)

The author and the photographer have taken the age old miracle of the sexual reproduction of flowers, to a new high in beauty and instructive usefulness. The text is almost superfluous when considered along with the tremendous life cycle photography. They have used the corn poppy to illustrate in minute detail the steps from bud until the ovules have become seeds. Many of the photos are enlargements including some from the microscope.

There are numerous illustrations of other flowers which change sex, of those which have a different flower for each sex, of ones which are pollinated by the wind as well as the ones which are pollinated by various insects.

Throughout the book there is a dual text, the larger print telling the main story, while the smaller print gives detail. Junior high and younger students will be able to understand the larger text, while more advanced students will want to make use of the detailed text.

JAMES E. RICHARDS, JR.
Roosevelt Junior High School
North Bend, Oregon

BASIC ELECTRONICS. Van Valkenburgh, Nooger & Neville, Inc. $10.50. John F. Rider Publisher, Inc. New York. 1955.

Those science teachers seeking a book which will act as a good reference source for themselves and their students in the field of electronics might want to choose this text. Written for the basic electronics classes of the Navy, this book attempts to make this technical field understandable regardless of the student's previous experience in the area.

The text contains within its covers five volumes, one each on power supplies, audio amplifiers, video amplifiers, transmitters, and receivers. It is designed to follow the authors' previous publication, *Basic Electricity*.

Each volume develops its subject slowly and thoroughly. There is an abundance of clear, cartoon-like illustrations, many of which could be adapted for use as teaching aids in the classroom. There is an index at the end of each volume and a cumulative index at the rear of the book.

Outstanding to the mind of this reviewer is the simplicity with which the more difficult subjects have been presented. Use of a high school level vocabulary plus an excellent selection of illustrations makes this a good reference text in any physics or radio classroom.

WILFRED H. HUPP
Marion-Franklin High School
Columbus, Ohio

SCIENCE FOR PROGRESS. Maurice U. Ames, Arthur O. Baker, and Joseph F. Leahy. 568 pp. $4.40. Prentice-Hall, Inc., New York. 1956.

The authors have succeeded in doing what others have attempted, namely that of combining scientific information with a style of writing that makes a strong appeal to the adolescent.

The use of multicolor in pictures and diagrams adds spice to what otherwise becomes a drab figure of black and white. The use of italic print gives emphasis to material that a youthful reader could easily pass over as just words to read.

The organization of a cycle for study is developed in a very interesting manner. The "Ideas to Remember" serve to emphasize important points of the cycle. The "Can You Do These" challenge the pupil to try many things for himself. The "How Would You Answer These" provide an excellent review test, usable by both pupil and teacher.

A criticism that certain topics should be given a longer treatment may be offered but I believe that is where some writers err. If a course is to be only reading about something, then pages of material are acceptable. If one wants time to spend with the pupil in developing activities other than reading, then the shorter treatment of a topic is to be preferred.

DEAN C. STROUD
Amos Hiatt Junior High School
Des Moines, Iowa.

CAREERS AND OPPORTUNITIES IN SCIENCE. Philip Pollack. 252 pp. $3.75. E. P. Dutton & Co., Inc., New York. 1954.

In this book written especially for high school students, Mr. Pollack wisely uses an interesting and conversational manner of writing which makes you think he is speaking directly to you, the reader.

The author points out several important thoughts that every science teacher would have the prospective scientist understand: Science and the wonderful advancements made by "science" are the results of *people*. While science research is relatively new and the study of science, as such,

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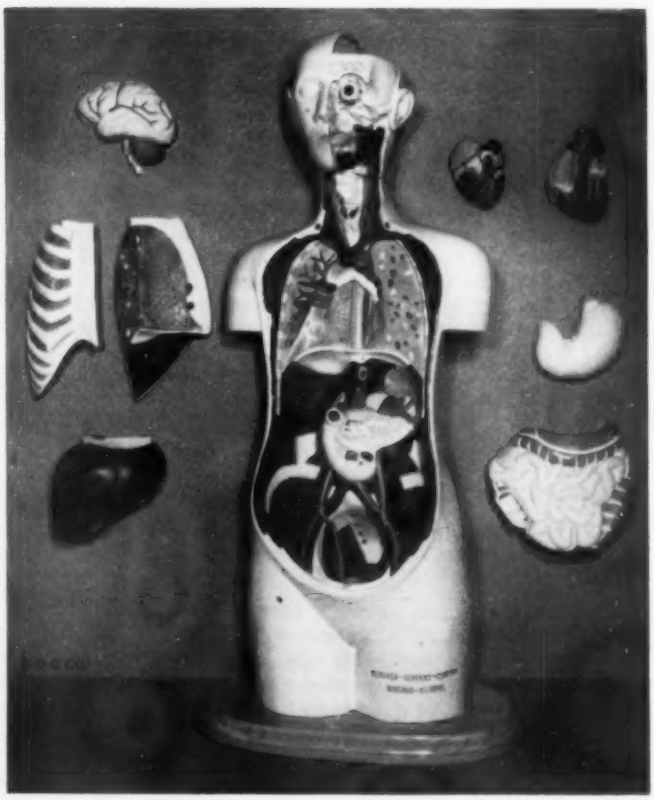

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in high schools and colleges only slightly older, there is an ever-growing importance given to the study of science. Earning power as a scientist may not be great but job security and demand in the departments of teaching, writing, and research is sufficient to make it attractive for those who like the sciences.

Mr. Pollack identifies for the reader some of the qualities of a good scientist. He instructs the reader in the background and opportunities in such fields as agronomy, archeology, atomic energy, astronomy, conservation, forestry, plastics, electronics, chemistry, physics, meteorology, medicine, and others. In each field examples and cases are used to make reading even more interesting. Photographic plates are liberally scattered throughout the book.

CHARLES W. ALBER
Blaine Junior High School
Muncie, Indiana

LOOKOUT FOR THE FOREST. Glenn O. Blough. 48 pp. $2.25. McGraw-Hill Book Company, Inc. New York. 1955.

Conservation teaching sometimes is technical and abstract, but this is not the case if children become acquainted with the forest along with Ted Riddle in this latest book by Mr. Blough.

With Ted and his father the children discover the value of a forest and also its many enemies.

The climax comes when Ted finally achieves his ambition of visiting the fire tower. He is just in time to see a forest fire brought under control.

GRACE C. MADDUX
Assistant Supervisor of Science
Cleveland, Ohio

FAMOUS INVENTORS AND THEIR INVENTIONS. Fletcher Pratt. 142 pp. $2.75. Random House. New York. 1955.

Written for the teen-age reader, *Famous Inventors and their Inventions* should find a wide audience. Of particular interest is the fact that many not-so-well-known, but equally important inventors and their experiments are included. It provides a more complete history and description of such inventions as gunpowder, radio, the submarine and the incandescent lamp. Historically and scientifically sound, the book employs simple vocabulary and black and white sketches which enhance its appeal to the youngster interested in science, history, or "just inventions."

The short stories are described under eight titles including: "From the Jib Sail to the Airplane," "Inventions for the Home," and "Modern Wonders." Throughout the book, summaries are presented which emphasize the impact of these inventions upon our daily lives. This book should find a niche on the shelf of every junior high school library.

ELIZABETH A. SIMENDINGER
Uniondale High School
Uniondale, New York

THE LIFE OF BACTERIA. Kenneth V. Thimann. 775 pages. $13.50. The Macmillan Company, New York. 1955.

This is a text for advanced college use which will find a useful place on the reference shelf of the high school biology teacher. The role of bacteria in the nitrogen cycle is very completely treated as is the broad topic of carbohydrate fermentation by bacteria.

RICHARD H. LAPE
Amherst Central High School
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Audio-Visual REVIEWS

SPRING IS AN ADVENTURE. 11 min. sound, 1955. $55 B & W, $110 Color. Coronet Instructional Films, Coronet Building, Chicago, Ill.

Recommendation: This film is suitable for the primary grades in science and social studies.

Content: With Mary Ann, the audience follows many of the exciting (to a youngster) changes in trees and flowers, birds and animals, and human activity which come with Spring. Watching the flowers bud and bloom, waiting for the robin's eggs to hatch, looking at baby turtles and tadpoles in a stream, and planting a garden are just a few of the special activities of this season shown in the film.

Evaluation: Film would be preferable in color. The sound was not satisfactory and was difficult to understand. Organization and photography were good. A Teachers' Guide accompanies film.

◇ ◇ ◇

FISH OUT OF WATER. 11 min. sound, 1954. $45 B & W, $90 Color. Moody Institute of Science, 11428 Santa Monica Blvd., Los Angeles 25, Calif.

Recommendation: Suitable for upper elementary, junior high, and senior high school classes in general science and biology.

Content: The film deals with the life cycle of the grunion. Close-ups show the grunion nesting in the sand, and the female's desperate struggle for survival after the eggs are laid. Eggs removed from the sand are taken to the laboratory where the embryonic development of this small fish is studied. The precise relationship of the hatching process to the tide movement is demonstrated. A "master plan" for such precise planning in nature is indicated.

Evaluation: The film is well done and the sound is good. The life cycle of these interesting fish is well demonstrated. The relation to the flow and ebbing of the tides is explained in detail. Color is helpful, but not necessary in this film. Teachers' Guide is included.

◇ ◇ ◇

ENEMIES OF HEALTH AND WEALTH. 54-frame filmstrip, 1954. B & W. Available free from Galvanized Ware Mfg. Council, Public Relations Dept., 221 N. La Salle St., Chicago 1, Ill.

Recommendation: May be used in intermediate, junior high, and senior high school classes in health, general science, biology, and Community Clean-up Week.

Content: The filmstrip deals with the role that rats and flies play in the spread of disease and destruction around the home. It shows why these pests are dangerous enemies of health, and clearly indicates various means of control. Methods of control emphasized are to starve rats and flies, to kill those that come into or near the home, and to keep constantly on the alert for these pests.

Evaluation: The filmstrip was well done with good photography. No brand names are used in the presentation. An excellent, illustated Teachers' Guide and commentary with each frame is provided.

◇ ◇ ◇

THE BUTTERFLY. 6 min. sound, 1955. $27.50 B & W, $55 Color. Coronet Instructional Films, Coronet Building, Chicago 1, Ill.

Recommendation: Particularly suitable for use in high school biology and junior high general science. May also be used in upper intermediate grades if the vocabulary is discussed in advance.

Content: The complete life cycle of the Monarch Butterfly is shown as an example of metamorphosis in the Lepidoptera. The egg, larva, pupa, and adult stages are noted and explained. The film also offers several methods by which butterflies and moths may be distinguished from each other.

Evaluation: Excellent photography and sound with fine close-ups of the insect in various stages. Time of emergence from the pupa is well illustrated. Should stimulate discussion and interest at all levels. Color is a distinct addition to this type of film.

◇ ◇ ◇

ATOMIC FARMER. 12 min. sound, 1955. $55 B & W. Handel Film Corporation, 6926 Melrose Ave., Hollywood 38, Calif.

Recommendation: Suitable for junior and senior high schools in science, social studies, biology, chemistry, and agriculture.

Content: The film shows the way tracer elements are used in the latest scientific agricultural experiments. Mutations in corn exposed to atomic radiation are seen. Animal studies with radioactive iodine injections are shown. Soybeans grown in an atmosphere of radioactive carbon dioxide are shown being studied. The latest developments in the use of radioactive materials in science are brought out.

Evaluation: Organization of the film is excellent, and the commentary adds a great deal. The scenes of the various areas of scientific research and the use of tracer elements are well chosen. This film is one of a series being produced as the *Magic of the Atom* with the technical assistance of the A.E.C.

◇ ◇ ◇

WINTER IS AN ADVENTURE. 11 min. sound, 1954. $55 B & W, $110 Color. Coronet Instructional Films, Coronet Building, Chicago 1, Ill.

Recommendation: Suitable for the primary level. Could be used in the study of science, nature study, art, and the community.

Content: Snow frosting all the out-of-doors, close views of animals in winter, and a lively boy exploring a farm make up a rapidly-paced film. We follow Scotty as he discovers the changes in nature. We observe with him the adaptations of animals to the snow and cold of winter.

Evaluation: The first and second grades should derive much fun from this film. The vocabulary used should stimulate much discussion and further exploration of the topic. Photography and sound are good. Teachers' Guide.

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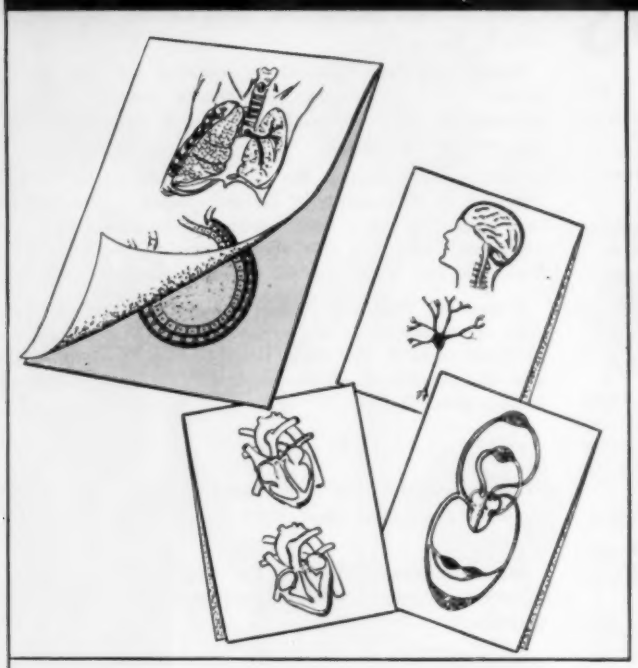

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EDITOR'S COLUMN—continued from page 79

National Association of School Boards? Where would the money come from that would be needed to administer this "National Reserve" for science teaching?

How many scientists are "qualified" to step into teaching positions for a year—and to do the job that teaching consists of today? It should be remembered that the teacher of chemistry, especially in a small school (where shortages are most likely to occur), must do many other things besides "teach chemistry." There is a home room and its associated record-keeping; the scientist probably would teach general science, biology, mathematics, and possibly one other course; he would serve on faculty committees and attend PTA meetings; he would (or should) attend two or three general and science teachers' meetings during the year; he might, and probably would, accept some extra-curricular activity such as coaching the basketball team or the junior class play and serving as adviser to the school's fire safety committee, or the cheerleaders, or the student council. Oh, yes; I almost forgot that there would be study hall assignments and lunchroom duty.

But let me hasten to say that most teachers accept the notion that these "extras" are a desirable part of American education—sports, dramatics, student committees and student government, and the like. In most schools, these "extras" are truly extra; they do not cut in on students' time for academic studies, the criticisms of uninformed critics to the contrary notwithstanding. They do, however, *take time and energy of teachers;* and this is where teachers ask for, even gripe about, assistance that will produce a reasonable work week for them and enable them to do a *good* job in all aspects of the teacher's job today.

It is this concept of teaching that I fear the "qualified scientists" simply would not understand; could not be expected to understand. And this concept of the functions of the schools and teachers in the education of all the children of all the people could not readily be reduced, for science, simply to the teaching of biology, chemistry, and physics. Don't all of us, as parents, want our children to achieve in academic spheres and *also* to have the benefits of democratic experiences, advisory services, and the advantages of full participation in living as they grow and mature into citizens? I think we do.

But one should not criticize a positive suggestion, as I have been doing, without offering what he thinks is a better one. And I think I have it. It is not original. It is very simple. It calls for no super-committee to organize and administer; it would require no fund to underwrite administrative costs.

It is this: All over the country, let all the industrialists, business men, Chambers of Commerce, scientists, and all the other non-school citizens *who are interested in the schools* join forces in a vigorous, action campaign to achieve as nearly as possible in every community the goal of the National Education Association for a salary schedule for teachers ranging from $4200 to $9500.

For the past several years we have been losing about 50 per cent of the university output of decided, trained, and certified science teachers mostly because they simply could not afford to take positions at the going rates. Instead of making up for this by lend-lease scientists, let's get these and future potential teachers into the schools *for keeps* by getting salaries up to reasonably attractive levels. What excuse can there be for paying a competent, Master's degree, 6-years experience teacher in the shadow of Oak Ridge, Tennessee, only $3000 a year? We are ready to admit that the Oak Ridge effort and the efforts in hundreds of other scientific research centers must depend upon a plentiful flow of capable, educated, and inspired young people from our high schools. To get this takes good teachers. Let's pay what it takes to get and keep them.

If the science teacher is truly a member of the scientific team, as many have recently proclaimed (and a viewpoint which I applaud), then let's treat *and pay* him like he is.

Once more, though, I must hasten to add a qualifier, I am not making a plea for differential and higher salaries for science teachers. Industry is the first to want our high school graduates more literate in English—and so we need good English teachers, and more literate in economics and the American way of life—and so we need good teachers of the social studies. The need for technicians is great—and so we need good teachers in the industrial arts fields and in our technical schools. Anyone who has tried to hire office personnel knows the need for more well-trained typists, stenographers, secretaries, and office managers—and so we need good teachers in the business departments of our high schools.

It's so obvious, so simple. Why don't we do it? Salaries, merited but not overdone recognition of the key role of high school teachers, and teaching conditions—improvement in these factors is the surest way of getting and keeping good teachers. Business-industry, which is so dependent on *all* the output of the schools, ought to take the lead in working for these goals. The initial and key step, I say, is salary improvement. In the long run, this will prove to be the soundest and most productive course of action.

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Activities of NSTA AFFILIATES

Four organizations have been added to the roster of NSTA affiliates: the DES MOINES TEACHERS SCIENCE CLUB, THE FOUR COUNTY SCIENCE CLUB OF THE CENTRAL WILLAMETTE VALLEY (OREGON), THE SCIENCE SECTION OF THE MAINE TEACHERS ASSOCIATION, and the SOUTHERN OREGON SCIENCE TEACHERS ASSOCIATION. We are confident that the strengthening of lines of communication and cooperation inherent in affiliation will be mutually beneficial. The number of NSTA affiliated groups on local, state, and national levels has now reached sixty-nine.

► The IOWA SCIENCE TEACHERS ASSOCIATION met in November at East High School in Des Moines. Dr. John S. Richardson of The Ohio State University spoke to the secondary section on "Demonstrations in Teaching and Testing in Science." Miss Bernice Kesterson of Adams School in Des Moines was the speaker for the elementary section. Her topic was "Science Reading Readiness in Lower Grades."

► The PHILADELPHIA SCIENCE TEACHERS ASSOCIATION will climax an active year with two spring meetings. The first, to be held in April at the Schoolmen's Week meeting, will have Mr. James Fowler of the Academy of Natural Sciences as speaker. Mr. Robert W. Neathery of Episcopal Academy will speak at the May meeting, to be held in conjunction with the Franklin Institute. The Association's program this year has emphasized ways of interesting students in careers in science, and coordinating science activities in the classroom to save the time of teachers and pupils.

► Congratulations to the SCIENCE SUPPER CLUB OF NORFOLK COUNTY (Virginia). This is the first group participating in the affiliate rebate plan to achieve 100% membership enrollment in the affiliate and NSTA. All the science teachers in Norfolk County support both organizations.

► The STUDENT AFFILIATE GROUP OF SAN JOSE STATE COLLEGE has invited Dr. Gertrude Cavins, the Advisor of the Group, to lead a lecture-seminar entitled "Challenge to Science Teachers." Other spring plans include trips to the Washington Union High and Bay Area Science Fairs, and a nature hike when the wild flowers are blooming.

All NSTA affiliated groups are urged to notify NSTA as new officers are identified, and as their programs develop.

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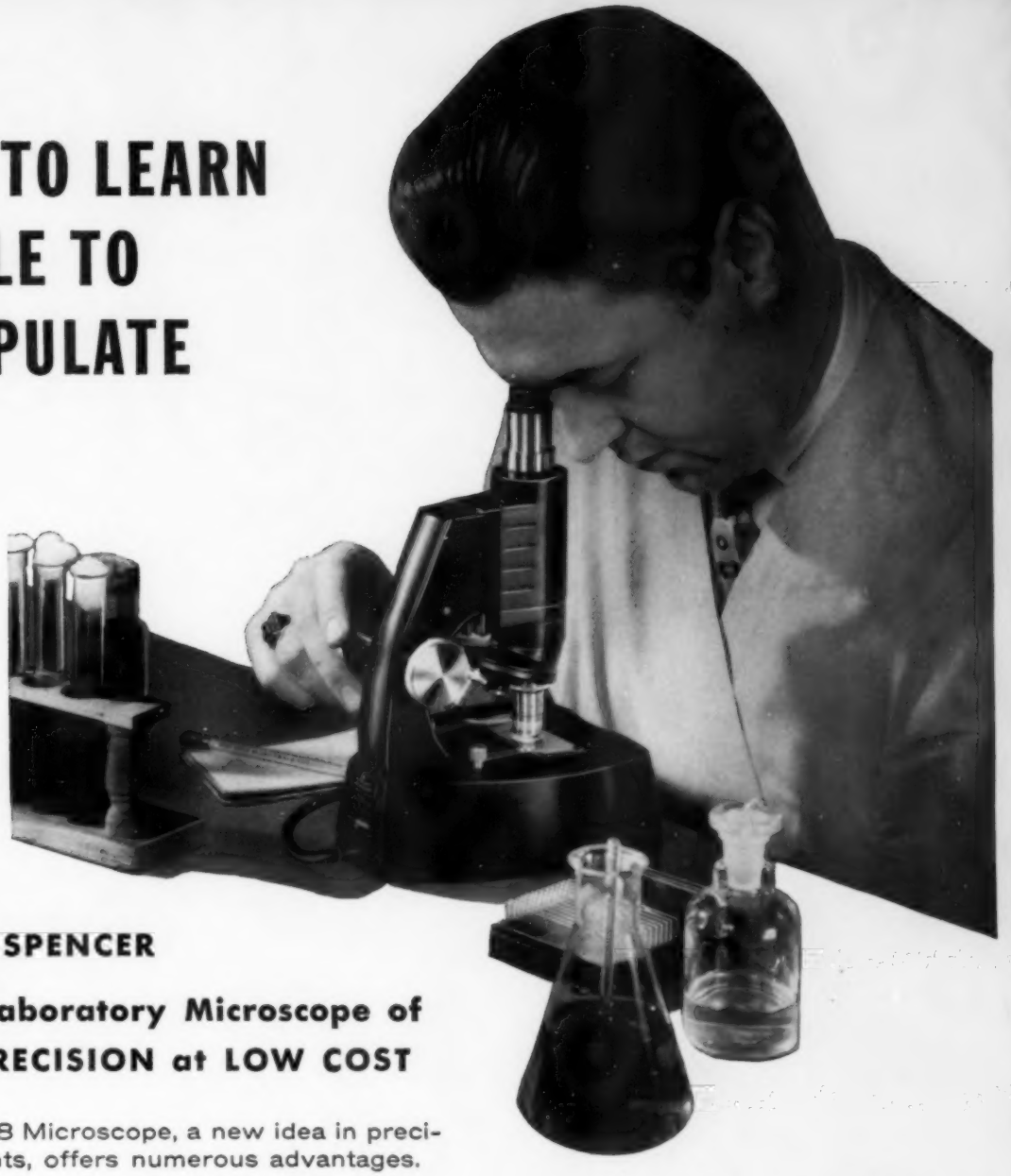

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